THE REFINER AND NATURAL GASOLINE MANUFACTURER

Vol. 3 No. 4 APRIL, 1924 $1.00 Per Year

In This Issue

Cooling condensing waters important item in refinery operation. Many improvements possible for greater efficiency

Improved technique aiding California plant men to get more satisfactory results. The second of a series of articles on California refinery development

Determining gasoline content of crude. One concern has worked out a very simple but efficient method

A model gasoline plant where mechanical arrangement has been made with idea of simplification

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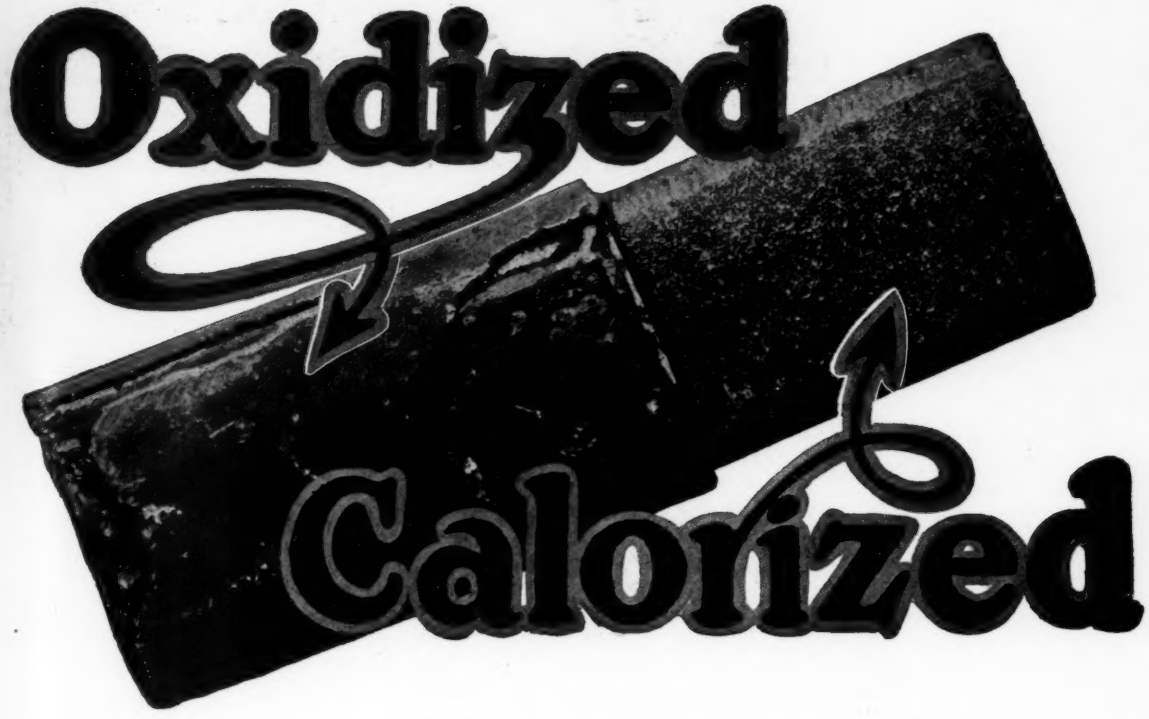
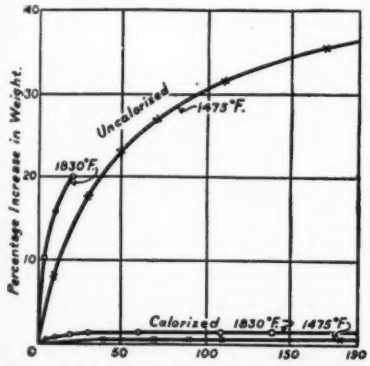
STEEL PLATE CONSTRUCTION



-subject to identical conditions!



These curves show how steel tubing fails when exposed to heat while Calorized tubing stands up perfectly. These curves were prepared by the General Electric Co. Research Laboratory. The steel tubing marked "Uncalorized" gains weight as it oxidizes and at 1830° F. after 20 hours scaled so badly that the curve could not be carried further. The Calorized specimens, after the first slight gain, continued practically unchanged for the duration of the tests.

At the left you see a plain steel tube, oxidized by heat. Steel, as you know, starts oxidizing at 900° F. At the right, you see a Calorized Tube. Note its perfect condition, after withstanding the same conditions that so badly scaled the plain steel. Calorized tubes withstand metal temperatures up to 1650° F.—and surrounding gases up to 2000° F. or over.

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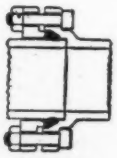
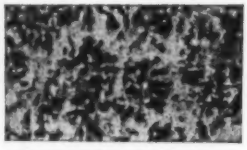
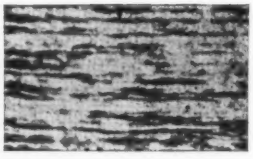


"ONE FLANGE IS LOOSE"

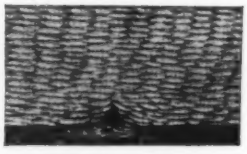
COATS ITSELF



Photomicrograph of cast iron, much enlarged, showing granular structure.



Photomicrograph of wrought iron, much enlarged, showing fibrous structure.



A piece of sheet steel, much enlarged, showing surface and sectional structure with a typical pit.

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In place of the interlocked grains or crystals of cast iron, wrought iron and steel are of a fibrous and, in thinly rolled steel, of a laminated structure, with distinct leaves overlapping each other. As corrosion takes place, these leaves or fibres scale off, constantly presenting a fresh surface to the corrosive agent.

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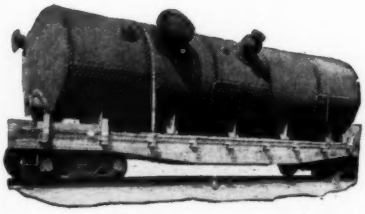

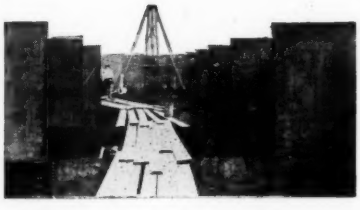

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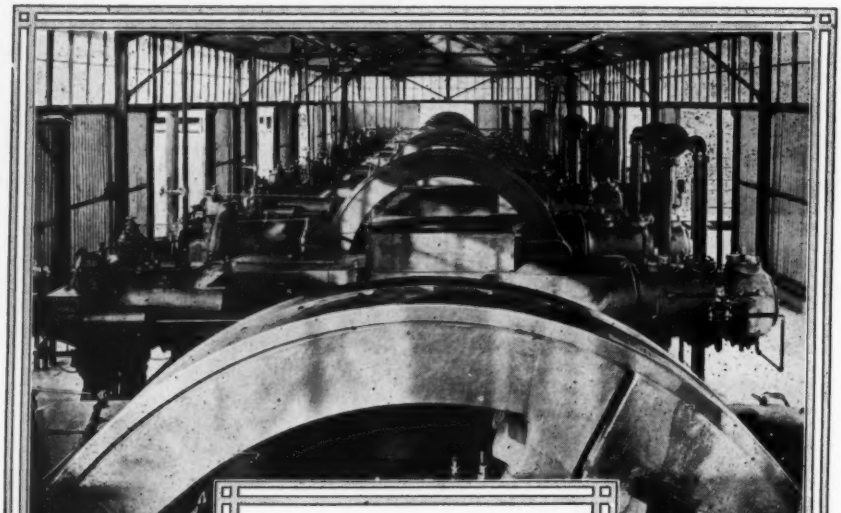

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The REFINER and NATURAL GASOLINE MANUFACTURER
Published Monthly by GULF PUBLISHING Co.
Houston, Texas

For men engaged in the operating branch of the refining and natural gasoline business.

Vol. 3 April No. 4

R. L. DUDLEY..Manager and Editor

Price .....$1 per year

Advertising rates upon application to nearest office.
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"Entered as second-class matter June 16th, 1923, at the Postoffice at Houston, Texas, under the Act of March 3, 1879."

Gasoline Men Ready for Spring Meet

Technical program promises interesting sessions for get-together in Tulsa

Tulsa, Oklahoma, April 11.—Plans are practically completed for the meeting of the Association of Natural Gasoline Manufacturers which is to be held here on April 23 and April 24. Special features of entertainment are being planned and these together with the unusually interesting technical sessions point to one of the most successful meetings ever held by the organization.

The natural gasoline industry has just emerged from the most trying period in the history of its development and those in charge ofthe convention are looking forward to much serious thought being given to various problems which are to be discussed.

The principal speaker of the convention will be the Honorable Victor Murdock editor and publisher of the Wichita Eagle, and former head of the Federal Trade Commission.

During the morning session of the first day J. Burr Gibbons, president of the chamber of commerce, will give the address of welcome, following which D. E. Buchanan, president of the association will make his annual address.

The gasoline situation on the west coast will be summarized in a paper, "The Future of the Natural Gasoline Industry in California," by K. L. Reynolds, assistant general manager of the Pacific Gasoline Company of Los Angeles.

L. F. Bayer, of the Tidal Refining Company will present an interesting paper on "The Stabilizer in Operation." Mr. Bayer is well known in the oil industry for his knowledge of the gasoline situation and his paper will be anticipated with interest.

"Recovery of Still Vapors in Straight Run Refineries," is the title of a paper to be read by D. B. Dow of the Bureau of Mines, Bartlesville Station.

At 10:00 a. m. of the second day, the business meeting will be held, following which there will be a question box discussion by field men and plant operators.

D. E. Buchanan will act as toastmaster at the annual banquet to be held at the Hotel Tulsa at 6:30 p. m. on the second day of the convention. Special entertainment has been provided for visiting ladies.

Following is the complete program of the association:

Program of Third Annual Convention of Association of Natural Gasoline Manufacturers

Wednesday, April 23—Morning Session

10-10:30 Registration.

10:30 Address of Welcome, J. Burr Gibbons, President Tulsa Chamber of Commerce.

Annual Address—D. E. Buchanan, President, Association of Natural Gasoline Manufacturers and Vice-President Chestnut and Smith Corporation.

Paper—"The Future of the Natural Gasoline Industry in California," by Kenyon L. Reynolds, Assistant General Manager, Pacific Gasoline Company, Los Angeles.

Discussion.

Standing Committees Selected for Refiners

Kansas City, Mo., April 12.—At the annual board meeting of the Western Petroleum Refiners Association, held here on March 22, chairmen and standing committee members for the year were chosen.

Active work of the association is carried on through a number of committees each of which has charge of a division of the work.

The manufacturers committee is headed by C. L. Henderson of the Vickers Petroleum Company, Wichita, Kansas. D. E. Buchanan, of the Chestnut & Smith Corporation, Tulsa, Oklahoma, was elected chairman of the traffic committee. W. M. Welch of the Tidal Refining Company, Tulsa, Oklahoma, was made chairman of the committee on finance and J. H. Miller of the Miller Petroleum Company, Kansas City, Missouri, was elected chairman of the membership committee.

Each committee has a number of other members selected from refining organizations scattered throughout the country.

Afternoon Session

2 p. m. Paper—"The Stabilizer in Operation," by L. F. Bayer, Manufacturing Manager, Tidal Refining Company.

Discussion.

Paper—"Recovery of Still Vapors in Straight Run Refineries," by D. B. Dow, Bureau of Mines Experimental Station, Bartlesville.

Discussion.

April 24

10 a. m. Business Meeting and Election of Officers.

10:30 a. m. Plant Operators Session, A. M. Ballard, Chairman.

Note—This session will be entirely devoted to plant operators and field men and will be in the nature of a Question Box. At this meeting anything of interest may be discussed by the field men.

Afternoon Session

2 p. m. Paper—"Natural Gasoline; Its Place in a Straight Run Refinery," by W. K. Holmes, Superintendent West Tulsa Refinery, Texas Company.

Paper—"The Relation of the Producer to the Natural Gasoline Manufacturer," by Ray Short, Superintendent Casinghead Gas Division, Prairie Oil and Gas Company.

Paper—"The Relation of the Natural Gasoline Manufacturer to the Producer," by E. L. Peck, Superintendent Natural Gasoline Division, Empire Gasoline Company.

Paper—"The Producer and the Natural Gasoline Manufacturer," by D. B. Dow, Bureau of Mines, Bartlesville.

Banquet, Hotel Tulsa, 6:30 p. m.

Toastmaster, D. E. Buchanan.

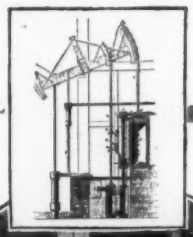
Principal Speaker—Hon. Victor Murdock, Wichita, Kansas.

Note—Following the banquet there will be dancing and cards.

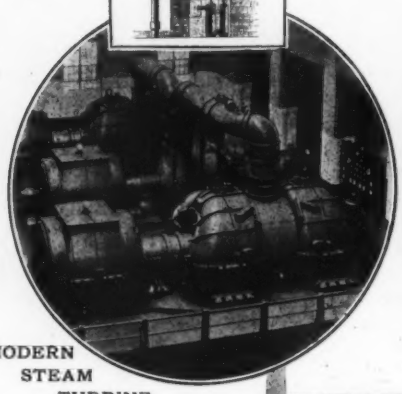
For the first time in the history of the association's conventions special entertainment will be provided for visiting ladies.

All business sessions of the convention will be held in the ball room of the Elks Club.

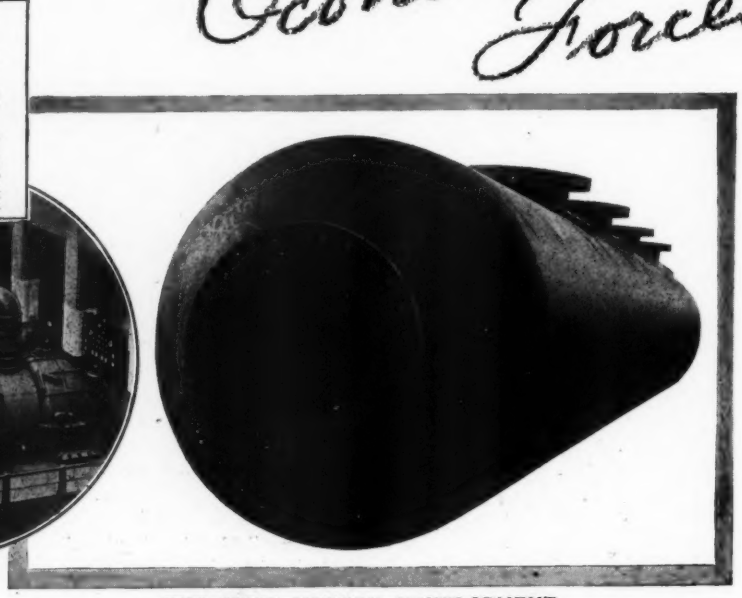
Pressure of Economic Forces



WATT'S ORIGINAL STEAM ENGINE 1774



MODERN STEAM TURBINE



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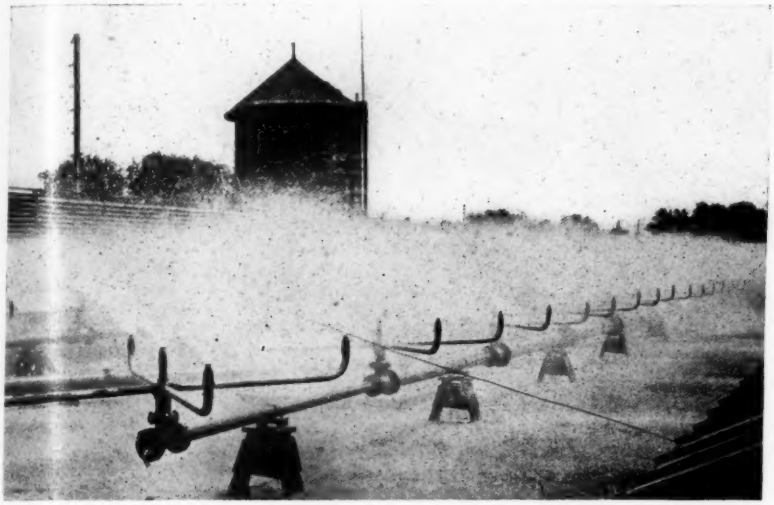
FORGE AND HAMMER WELDING

Cooling Condensing Water a Problem

Item not always given much attention but has prominent place in operating efficiency

By Harry Pennington

THE value of cool condensing water is felt by every refiner running light oils and especially during the summer months, when atmospheric temperatures run high and condensers are apt to "blow." This blowing causes the loss of the lighter vapors that are particularly necessary for securing the low initial boiling point desirable, necessary in good gasoline, and which should be recovered to reduce the refining loss.



Water spray showing arrangement of nozzles, etc.

Condensing water temperatures, for light streams, necessarily should be lower than atmosphere, since the interior of the condenser is always higher than the cooling water temperature, and when lower than atmosphere temperatures are secured of the cooling water, the vapors that condense at or below atmosphere are not lost.

Many cooling systems are susceptible to improvement at trivial cost when compared to results, while others due to geographical location or other reasons, are not so easily handled. It is the idea of this article to present the fundamentals governing the cooling of water; and there are many factors involved, nineteen in all, but water cooling problems are based upon well known factors and may be handled with exactness.

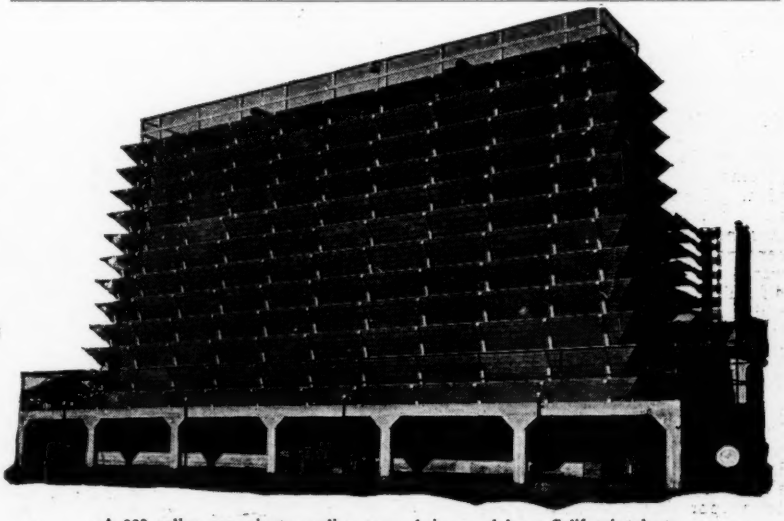
Since air constitutes the cooling agent in reducing the temperature of water, carefully obtained records of atmospheric conditions throughout the year are a prerequisite to computations necessary in handling cooling water problems intelligently. The relation of moisture content, temperature and barometric pressure has an unvarying value for a given condition and this relation is expressed as relative humidity. When water evaporates, latent heat of evaporation cools the remaining water; the wet bulb thermometer, when whirled, registers a lower temperature than the dry bulb, and the difference in temperature between wet and dry bulbs is a function of relative humidity. Dry air will take in more moisture than moist air, consequently the greater the difference in temperature between wet and dry bulbs, the dryer the atmosphere and the lower the relative humidity, since the wet bulb temperature is proportional to the amount of water vapor already present in the surrounding air.

Relative humidity is expressed as a percentage; when air contains all the moisture it can hold without precipitation, it is said to be saturated, and the relative humidity is 100%. When less moisture is present, the amount is designated in a percentage of the amount that the air could hold at the given temperature. Relative humidity is computed from the difference in temperature between wet and dry bulbs, the barometric pressure, and the vapor tension of water vapor at both wet and dry bulb temperatures. The vapor tension may be obtained from any steam table but the readings of wet and dry blub thermometers and barometer must be taken, using the hygrometer.

For making calculations, Apjohns' formula or its modifications, is used for hygrometry; tables are published by the United States Weather Bureau of the relative humidity for any difference in temperature. Most tables are based upon a fixed barometric pressure, but where the barometer varies from 29.921 inches of mercury to any extent, as at an altitude, it is necessary to include the barometric pressure as a factor.

The United States Weather Bureau makes observations daily at 7 a. m. This changes materially by mid-day, the relative humidity lowering, and the temperature of the atmosphere rising, so that for practical use commercially, a 7 a. m. reading is not sufficient.

When air is completely saturated with all the moisture it will hold at any temperature, such air is at the dew point; the higher the temperature of air, the more moisture it can contain; the higher the pressure, the lesser moisture it can contain. One thousand cubic feet of a mixture of air and water vapor, saturated, weighs 75.252 pounds at 60 F.; the weight of the vapor is 0.83 pounds. At 100 F., 1,000 cubic feet of air weighs 69.261 pounds and the weight of vapor is 2,848 pounds, which illustrates the additional carrying capacity of air at higher temperature. It



A 900 gallon per minute cooling tower being used by a California plant.

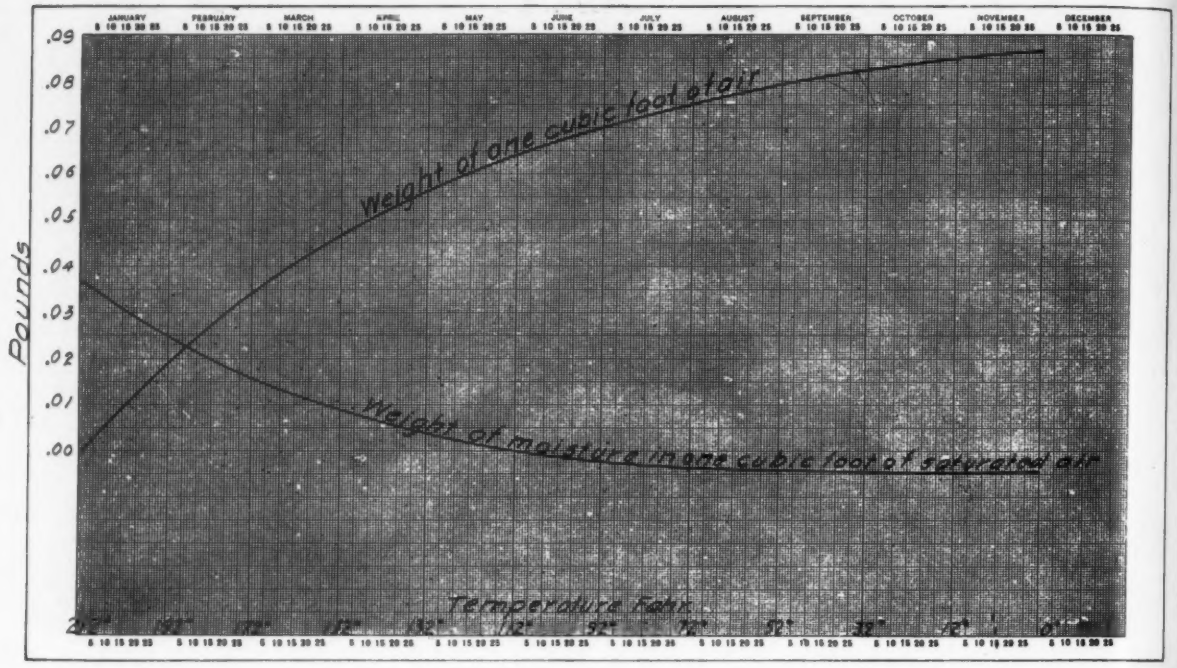


Fig. 1

is this feature that enables cooling of water to be carried out in hot weather and effectively. Temperatures of cooling water may be brought well below atmosphere, within two or three degrees of the wet bulb temperature, when the atmospheric temperature is high. As atmospheric temperatures lower, the obtainable difference in cooling water temperature lowers in the effect obtained by evaporation, although the air itself may cool the water by taking heat by conduction.

The heat absorbed by one cubic foot of saturated air per degree F. reduces as temperature rises; the volume of a unit measure of air increases with temperature; then, the weight of one cubic foot of dry air is less as temperature rises.

The accompanying curve of Fig. 1 expresses some of the important relations between temperature and moisture of air.

Air, to become saturated with water vapor, must contact water, so in arid sections, relative humidity is low, offering a better opportunity to cool water. On the other hand, on the seashore with sea breezes, moisture laden from passing over the water, or near lakes of magnitude, in rainy districts, where an opportunity is present for the atmosphere to absorb moisture, the percentage of moisture is higher, and the water cooling problem becomes more difficult. The lowest temperature to which can be reduced by evaporation is the temperature of the wet bulb and this temperature is higher in humid districts.

The writer made observations of the relative humidity in the Salt River Valley, Arizona, in 1908 before the Roosevelt Dam was finished; seven years later, after the district was irrigated, the relative humidity had increased, due to evaporation and consequent greater saturation of the atmosphere.

The amount of heat required to be extracted from one pound of water to cool it one degree F. is one B. t. u., the heat of the liquid. But the quantity of heat required to evaporate one pound of water at atmospheric pressure is 970.4 B. t. u.'s, which is the latent heat. So, to cool water, we must evaporate some of it to secure the maximum cooling effect, and some of the water is carried off in the air as vapor and lost.

In addition to cooling water by evaporation, an appreciable amount of heat may be carried away by conduction. The simple cooling pond without nozzles or tower is cooled by conduction, radiation and evaporation. Since air is seldom saturated, its capacity for holding moisture is increased due to rise in temperature upon contact of the air with the warmer water being cooled.

The cooling action of a pond is independent of its depth—each square foot dissipates an amount of heat depending upon the temperature of the water, and the temperature relative humidity and velocity of air over the pond. Under the most favorable conditions an enormous pond surface is necessary to do the work that a few nozzles or a tower will do. Tests of ponds vary so widely that there are no exact data covering their performance; no control of conditions is had in the least when a simple pond is used for cooling condensing water and the spray nozzle, natural draft cooling towers and forced draft towers are used where cooling water temperatures are desired to be brought under control for securing the maximum of operating results.

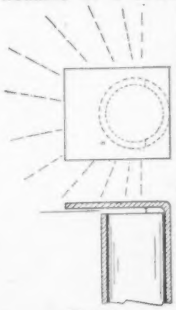


Fig. 2

Spray nozzles may be divided into two classes—those that depend upon velocity head and those that depend upon rotation of water to break the water up into fine particles so that more intimate contact with air will assist in evaporation and consequent cooling. Fig. 2 shows a small nozzle that spreads the water into a fan shaped spray. This nozzle depends upon pressure alone to break the stream into spray, and the pressure is therefore relatively high as compared with the centrifugal nozzle, which operates by giving the emerging stream rapid rotation, using both pressure and velocity head to secure such rotation. Fig. 3 shows a centrifugal nozzle. This nozzle will operate under very low pressure; some designs will break the water into fine spray with as low as five pounds pressure at the nozzle.

A finely divided spray cools water more, since the smaller spherical drops expose more surface of the same volume of water than larger drops. The surface of spheres is proportional to the square of their diameters while the volume is proportional to the cube of their diameters. The same quantity of water pumped at the same pressure will be materially cooler with well designed nozzles.

Spraying water falling from a height will induce air currents by entraining so that there is an appreciable circulation of air downward around the nozzle. A portion of this circulation is due also to the lower temperature of air under the spray, causing the air to fall and drain out, inducing more air from above the nozzle.

When nozzles are enclosed in a louvre house, a perceptible air current is present, coming in at the top and leaving through the bottom of the louvre. Considerable advantage is had by

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shading sprays from the sun. The roof necessarily should have pent house with louvre of ample dimensions for free air circulation. In Fig. 4 is shown a nozzle layout with the direction of induced air currents shown. Were this louvre house equipped with a draft tube above the nozzles to induce a natural draft, setting up a counter current of ascending air with descending water, cooling would be more uniformly and positively done.

While cooling nozzles set up a limited air circulation, their performance depends somewhat upon the wind as there is no positive control over the amount of air in contact with the water sprayed.

Cooling towers are designed in three general types; the open tower with mats, pans or gratings, which spread the water and through which the wind may flow; the natural draft tower, which has a chimney like structure, or draft tube above the mats, baffling or other filling, and the filling is so arranged to allow air to flow upward counter current to water flowing down; the forced draft tower which has large pressure fans to blow air upward between the mats down which water trickles. Combined natural and forced draft towers are also designed, with doors arranged to open and admit air for natural draft with the fans stopped.

The open tower is usually located with reference to prevailing winds since it depends upon velocity of wind for cooling. Wind velocity is extremely variable; it may be as high as 120 feet per second. There is always some wind, however, and when we speak of there being no wind, the velocity is generally two or three feet which figure is used in making calculations for this type of tower.

The illustration on page 9 is an excellent type of open tower with wide louvres to prevent loss of water from windage.

For better control over air circulation, the natural draft tower has been designed and an example is shown in Fig. 6. As may be seen, there is an air current induced by the draft tube, causing air to flow into the bottom of tower, through the filling and out of the top. Draft in this type is induced by the warmer air heating the air and causing air to rise through the baffles, counter current to the water, and a carefully designed installation will set up velocities that pass large quantities of air through with resulting efficient cooling.

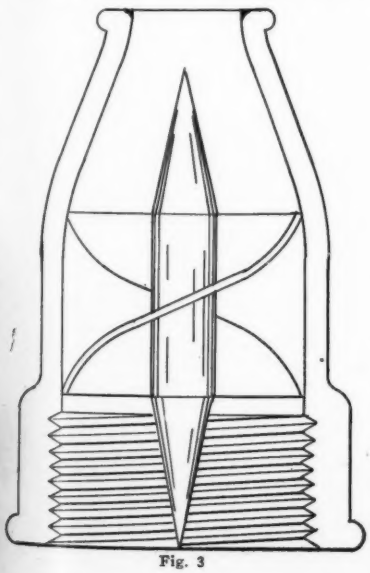


Fig. 3

The maximum draft in this tower is when the water is warmest and atmospheric temperature lowest, that is, when the water-atmosphere temperature difference is greatest. If the external air is cold, the emergent air will also be cool, and the temperature difference between air and water will be large. On the other hand, if the external air is warm, it leaves still warmer, and the mean temperature difference between air entering and air leaving is less. In the former case, the air takes up more heat by being warmed—conduction; in the latter case, more by the formation of vapor. And, when air is warmed its vapor carrying capacity is increased.

The velocity of water flowing down is arrested by the baffling or mats and there is no appreciable resistance to air flowing upward. The velocity of air in this tower reaches eight to ten feet per second, which passes large volumes of air through.

The natural draft tower requires no power for operation, is very efficient when well designed, and water may be cooled to within three or four degrees of the wet bulb temperature with this type tower. The average tower, however, does not carry temperatures as low, but the design is capable of reducing water to almost the wet blub temperature. By way of comparison, a tower to reduce water to within three degrees of the wet bulb temperature would be 70% to 90% larger than a tower to reduce only to atmospheric temperature.

Towers of this type will handle up to 25 pounds of water per square foot of surface, exclusive of inclosing surfaces, and will dissipate in air up to 800 B. t. u., per hour per square foot of surface with air entering at 70% and leaving at 90% relative humidity, causing a loss of 2½ to 3% of the water passing through.

Cooling tower designs are usually based upon relative humidity of 70%, but where the relative humidity is continually exceeded, as shown by observation, this figure will lead to unfavorable results, unless the tower is proportioned as to surface, velocity and quantity of air, air passages and draft tube to meet such conditions.

There are many designs of natural draft towers; but there is little difference in the efficiency and operating results of one design of this type as compared with another, where the designs are correctly made.

Where water temperatures are desired to be brought down to within two or three degrees of the wet bulb with the maximum cooling effect, larger volumes of air are used for which the forced draft tower is designed. Fig. 5 is such type of tower—the Wheeler-Barnard—which has vertically placed sheets of wire cloth down which water travels, forming films, with large volumes of air forced upward between the sheets by means of the large fans

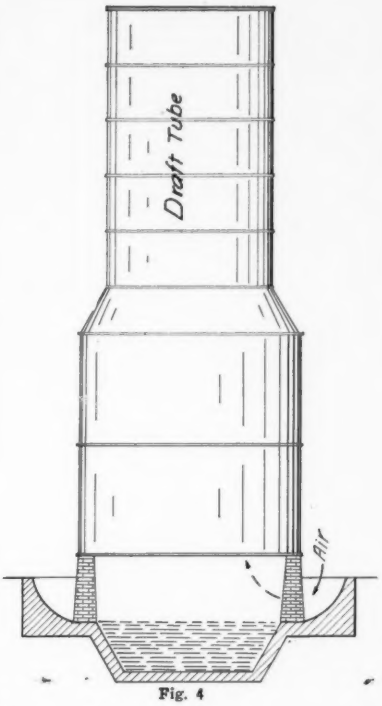


Fig. 4

shown. Both sides of the wire cloth sheets are effective, and this tower is very compact. The Worthington tower of another type is filled with chemical rings down which water trickles while air is blown in by fans of large capacity.

The velocity of air in this type of tower is arbitrarily fixed, twelve to fifteen feet per second being usually chosen, and pressure of ⅜ inch of water is generated by fans to force air through. Forced draft towers will dissipate more heat per square foot of surface, due to the greater amount of air passing through.

The fans are from five to ten feet in diameter, depending upon the size of tower, and are driven by belt or motor, which sets up an operating expense not present in the natural draft tower. The cost of the forced draft tower is more than the natural draft tower because of the mechanical equipment necessary.

When atmospheric conditions are favorable, the fans may not be necessary when the tower has a draft tube and to meet this condition, the Wheeler-Balke tower shown in sketch in Fig. 6. This tower, as may be seen, is a combination natural and forced draft tower. When atmospheric conditions are such that cooling is difficult, the fans are started, causing air to be drawn upward, through the fans, then back into the tower, thus securing the benefit of natural as well as forced draft. When relative humidity is low, and the fans are not necessary, they are simply shut down and the draft tube keeps up circulation of air.

This tower is an English design and was brought to America some years ago, proving very efficient and adaptable.

Other designs of forced draft towers have doors that may be opened, allowing natural draft, and a draft tube

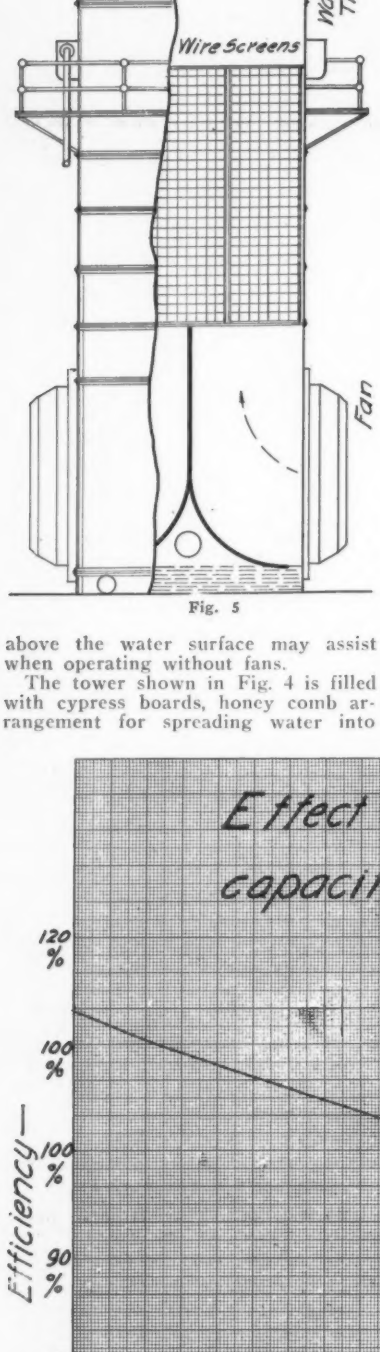


Fig. 5

above the water surface may assist when operating without fans.

The tower shown in Fig. 4 is filled with cypress boards, honey comb arrangement for spreading water into sheets. Many other kinds of filling are used. Chemical rings, which are not glazed, are not subject to much deterioration. For economy, it is evident that maximum void space, or thin sheets, will expose more surface per unit volume of tower, and will offer less resistance to the passage of air.

Water pumped over towers may be handled by reciprocating or centrifugal pumps. For nozzles, the latter are more desirable, since it furnishes a constant pressure of water without pulsation. When the centrifugal pump is motor driven or engine driven, it is more economical than the direct acting steam pump and requires very little attention. The centrifugal pump may be operated for long periods continuously and is worthy of consideration from the standpoint of economy, whether driven by its own prime mover or not.

Location of the average condenser box, water outlet at the top is usually at sufficient height to operate low pressure nozzles, when the spray pond is nearby. In such an arrangement, the pipe delivering water to the nozzle manifold necessary should be larger than ordinarily for the same quantity of water, so as to conserve the static head as much as possible. If the velocity of water in this pipe does not exceed four or five feet per second, the friction loss of head is lowered substantially from higher velocities.

Where water is stored in a large open pond, it is not usually possible to effectively cool the entire pond with nozzles located to spray down on a portion of the pond. An arrangement that secures cooler water is by placing the nozzles over a separate basin, furnishing the condensers from this basin, and supplying make up water from storage, or, if make up water from the

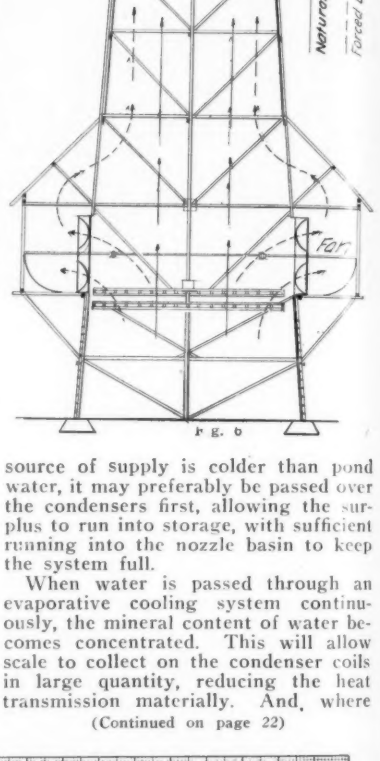
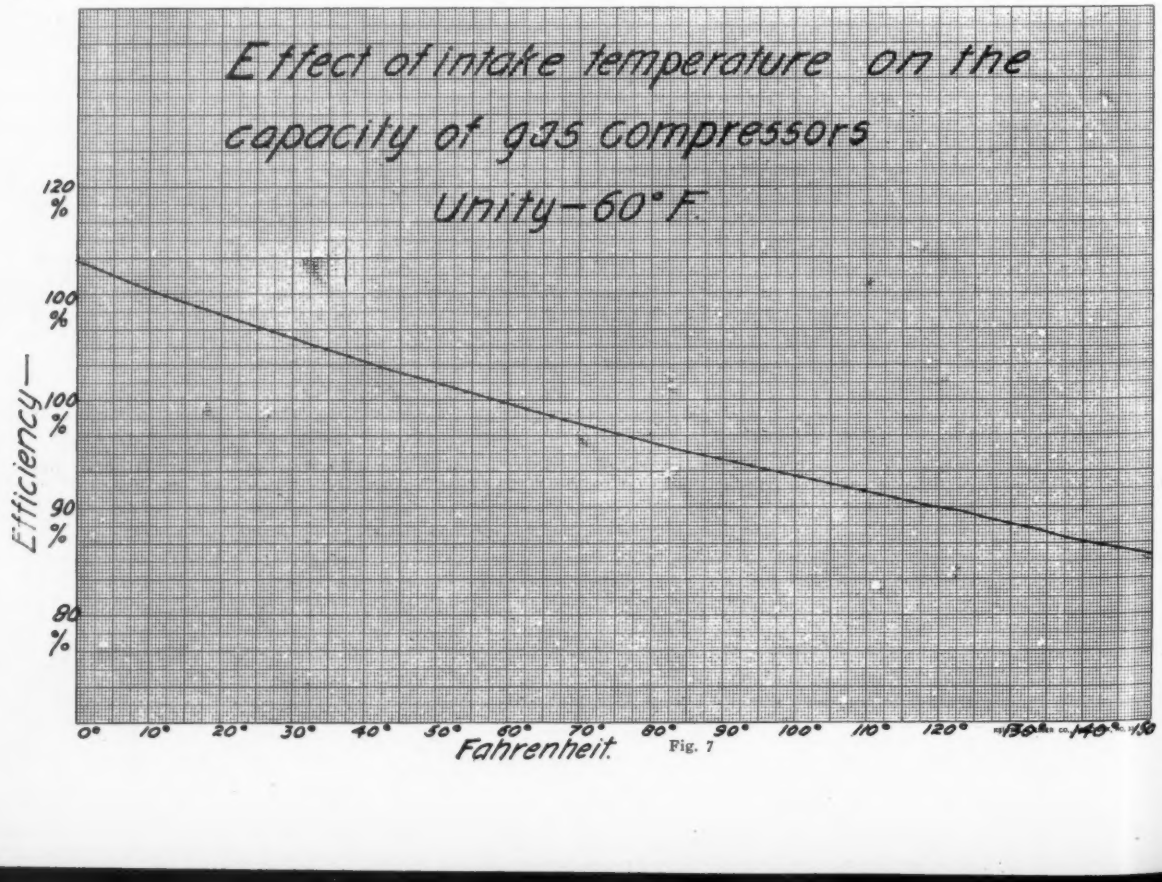


Fig. 6

source of supply is colder than pond water, it may preferably be passed over the condensers first, allowing the surplus to run into storage, with sufficient running into the nozzle basin to keep the system full.

When water is passed through an evaporative cooling system continuously, the mineral content of water becomes concentrated. This will allow scale to collect on the condenser coils in large quantity, reducing the heat transmission materially. And, where

(Continued on page 22)


Effect of intake temperature on the capacity of gas compressors
Unity—60° F.
Efficiency—
120 %
100 %
100 %
90 %
80 %
0° 10° 20° 30° 40° 50° 60° 70° 80° 90° 100° 110° 120° 130° 140° 150
Fahrenheit.
Fig. 7

Comparing Gasoline Plant Operating Costs

Putting industry on its feet means making the most of modern equipment and methods

*By Dean E. Foster**
Natural Gasoline Plant Engineer

THE "Hot Blending" of raw compression gasoline with naphtha has not been a profitable proposition for the past three years—and the plant operator who has been following this practice has undoubtedly wondered what course to pursue to make his plant a profit maker as well as a gasoline maker.

The big problem of a gasoline plant is not simply running the plant and making gasoline—it is "making money on the invested capital"—and in the following article the economics of the three methods of making natural gasoline (Compression, Compression-blending and Oil Absorption) are analyzed and compared.

To see clearly what constitutes the best process to use, the problem must be approached from the standpoint of "Dollars and Cents"—and in order to determine the basic reasons for the differences in price levels, between the products of the three processes, the wholesale prices of naphtha, naphtha blends (motor natural), raw compression and raw absorption gasoline over a period of several years, should be studied in their relation to those factors that basically affect the marketability of motor fuel products. The accompanying charts were prepared to give the necessary historical price background for this article.

Natural Gasoline Engineering

The refinements in the manufacture and utilization of natural gasoline have broadened out until today they occupy a field distinctly their own—and which may properly be called the field of Natural Gasoline Engineering.

In its "raw" state natural gasoline is not suitable for use in the present day types of motors. Its greatest economic value can be realized only by using it in some of the following ways: (1) by blending it with the heavy naphthas now being produced by improved methods of refining crude oil, (2) by blending it with "cracked" distillates, (3) by blending it with a combination of straight run gasoline and naphtha, or (4) by blending it with a combination of straight run gasoline, naphtha and cracked distillate.

For several years the compression plant owner made handsome profits by "hot blending" his raw product in the coils with naphtha. During the period of "high prices and prosperity" he was able to purchase his blending naphtha at prices varying from three to ten cents per gallon less than the prices at which he sold his blended motor fuel. This marketing margin of several cents a gallon, rather than properly designed and efficiently operated plants, was the chief reason why certain gasoline companies were able to "get by" during this era of long profits.

That this "price differential" has not prevailed during the past three years can be readily seen by referring to chart number four in the accompanying chart. This shows that during 1921 the compression plant owner who practiced blending paid only 0.20 of one cent per gallon less for his naphtha f. o. b. a refinery than he received for his blended motor fuel f. o. b. his loading rack. During 1922 this difference in price favored him to the extent of 0.65 of a cent, while in 1923 he paid out 0.03 of a cent more per gallon for naphtha than he received for his blend. The freight charges on naphtha from the refinery to the loading racks of most compression plants will average about 0.9 of a cent per gallon. Hence it will be seen that the cost of blending naphtha f. o. b. the loading rack exceeded the sales price of the blended motor fuel f. o. b. the same point by the following amounts: in 1921, about 0.70 of a cent; in 1922, about 0.25 of a cent; in 1923, about 1.03 cents. To these losses must be added the costs of unloading, blending, reloading, purchase and sales "overhead" involved in handling the extras due to blending.

Inefficiency of Straight Compression

The profitableness of blending, however, did not depend entirely upon the relative costs and sales values of naphtha, naphtha blend and raw compression gasoline, otherwise the practice of blending with naphtha would have ceased long ago on account of the high cost of naphtha. The inefficiency of the straight compression method of extracting natural gasoline from casinghead gas was recognized several years ago. Over three hundred tests, made by representatives of the United States Bureau of Mines and others, have demonstrated that the residue gas from these plants seldom contains less than one quarter of a gallon of gasoline per thousand cubic feet treated and that sometimes as much as three-quarters of a gallon was wasted in the residue, the average being about four-tenths of a gallon. Spraying naphtha into the high pressure coils causes about half of this residue gasoline to be reclaimed. The increased production from this source is, therefore, a step in the direction of "Profits". It is also a well known fact that weathering and loading losses are high where straight compression-made gasoline is manufactured, due to the large amount of "fixed" gases dissolved in the gasoline during compression. Blending with naphtha reduces these losses and therefore tends to increase the gross earnings of the plant. With high costs of naphtha on the one hand and increased net output of gasoline on the other, it is obvious that only a careful analysis will reveal the true facts of the case and make possible a sound conclusion as to the best policy to pursue. Therefore, let us compare the net tank car sales of gasoline from the two types of plants for the years 1921, '22 and '23. (For average compression gasoline price data see chart number one.)

Comparative Net Sales From Straight Compression Plant

Year	Gals.	Price	Gross Sales	*Net Sales
1921	8,000	$11.88	$ 950.40	$ 870.40
1922	8,000	15.40	1,232.00	1,152.00
1923	8,000	8.49	679.20	599.20

*Net sales equal gross sales less ½c per gallon for tank car rentals and ½c for sales overhead, or a total of $80.00 per car.

Government statistics on natural gasoline are not yet available for 1923, but those for 1922 show that the average net yield of gasoline in compression plants was 2.90 gallons per thousand feet of gas treated. Hot blending in the coils will save one-half of the four-tenths of a gallon of gasoline going to waste in the residue of the average compression plant or, two-tenths of a gallon. Reductions in weathering, evaporation, loading and outage losses due to blending will increase the net production by another three-tenths of a gallon and bring the total net production to about 3.40 gallons per thousand feet of gas. Therefore, the same amount of gas which produces a carload of 8000 gallons of raw compression gasoline will produce 9379 gallons by blending. (This amount is obtained by multiplying 8000 by the ratio of 3.40 to 2.90.) The gravity of average raw compression gasoline is 86° A. P. I. Average motor natural blend has a gravity of 64°. The amount of 51° gravity naphtha needed to convert the former into the latter is shown by the following calculation:

Raw Compression .....86°—13 parts
Motor Nat. Blend..... 64° } Total 35 Parts
Naphtha . .....51°—22 parts

In other words it will take 22 gallons of naphtha blended with 13 gallons of raw compression gasoline to make 35 gallons of 64° motor natural fuel. If we start with 9379 gallons of raw compression, we will need 9379x22/13 or 15,872 gallons of naphtha and the total production of motor natural blend will be 25,251 gallons. The total naphtha purchases and blend sales will be 15,872 plus 25,251 or, 41,123 gallons as compared to the sale of only 8000 gallons produced by the straight compression method, or, a ratio of about five to one. On account of the greater volume handled, the purchase and sales cost per gallon will be less, but the total cost of sales will be considerably greater. Therefore, a charge of one-quarter cent per gallon, or $39.68 will be assessed against the inbound naphtha and $63.13 against the outgoing blend to cover the overhead expense of naphtha purchase and blend sales. A charge of one-half cent per gallon was made against the straight compression product to cover sales overhead on account of the fact that a smaller quantity was being handled.

Tank Cars Used

Standard tank cars can be used for shipping in the naphtha and for shipping out the motor natural blend. These can be leased at a cost of about three-eights of a cent per gallon. The

*President Foster & Bowles Corporation, Tulsa, Oklahoma.

total tank car cost for this transaction, therefore, will be about $154.21. Raw compression gasoline of average quantity must be shipped in insulated tank cars on account of its greater volatility. These cars command a higher rental than standard tank cars, consequently a charge of one-half cent a gallon or $40.00 was made against the 8000 gallons of raw compression gasoline. A comparison of the charges against the two products shows that it costs $114.21 (or $154.21 minus $40 00) more to transport 9379 gallons of compression gasoline to market in the form of blend than it does to ship 8000 gallons of raw compression gasoline to market. The unloading of the raw naphtha and reloading of the naphtha "in the blend" will entail an extra cost of not less than one-eight cent per gallon for each handling, or a total of $39.68. Transportation charges of the naphtha from refinery to the gasoline plant loading rack at nine-tenths of a cent (0.9c) per gallon will total $142.85. The cost of the blended product f. o. b. loading rack may be summarized for each of the three years as follows: (For price data on naphtha costs and blend sales see chart number four).

Cost of Blended Product Year 1921
(Exclusive of Manufacturing Expense)

15,872 Gallons Naphtha F. O. B. Refinery	@	12.97c	$2,058.60
15,872 Gallons Naphtha Purchase Costs	@	0.25c	39.68
15,872 Gallons Inbound Freight Charges	@	0.90c	142.85
31,744 Gallons Unloading and Reloading	@	0.125c	39.68
25,251 Gallons Blend Sales Costs	@	0.25c	63.13
41,123 Gallons Tank Car Rentals	@	0.375c	154.21
Total Cost of Sales			$2,498.15
Gross Returns From Sales			
25,251 Gallons Motor Natural Blend	@	13.17c	$3,325.55
Net Returns from Sales			$ 827.40

Cost of Blended Product Year 1922
(Exclusive of Manufacturing Expense)

15,872 Gallons Naphtha F. O. B. Refinery	@	13.03	$2,068.12
15,872 Gallons Naphtha Purchase Costs	@	0.25c	39.68
15,872 Gallons Inbound Freight Charges	@	0.90c	142.85
31,744 Gallons Unloading and Reloading	@	0.125c	39.68
25,251 Gallons Blend Sales Costs	@	0.25c	63.13
41,123 Gallons Tank Car Rentals	@	0.375c	154.21
Total Cost of Sales			$2,507.67
Gross Returns From Sales			
25,251 Gallons Motor Natural Blend	@	13.68c	$3,454.34
Net Returns From Sales			$ 946.67

This figure, when compared with net sales of $870.40 from 8000 gallons of raw product shows a loss of $43.00 per car.

In 1922 a carload of raw compression gasoline netted an average of $1152.00. Hence in spite of the greater net yield obtained by blending, the compression-blender lost $205.35 per car—because he practiced blending.

Cost of Blended Product Year 1923
(Exclusive of Manufacturing Expense)

15,872 Gallons Naphtha F. O. B. Refinery	@	9.63c	$1,528.47
15,872 Gallons Naphtha Purchase Costs	@	0.25c	39.68
15,872 Gallons Inbound Freight Charges	@	0.90c	142.85
31,744 Gallons Unloading and Reloading	@	0.125c	39.68
25,251 Gallons Blend Sales Costs	@	0.25c	63.13
41,123 Gallons Tank Car Rentals	@	0.375c	154.21
Total Cost of Sales			$1,968.02
Gross Returns From Sales			
25,251 Gallons Motor Natural Blend	@	9.60c	$2,424.09
Net Returns From Sales			$ 456.07

The Refiner in 1923 charged the gasoline manufacturer more for naphtha for blending than the average market price for the blended motor natural fuel. Due to this fact, and the general condition of the whole gasoline price structure, the blender lost the difference between $599.20 (the net sales from a car of raw compression) and $456.07 (the net sales from the same material when blended), or $143.13 per car.

The following table summarizes the results of comparative net sales and shows conclusively that during the last three years naphtha blending did not pay.

Year	Comp. Blending	Straight Comp.	Loss by Blending
1921	$827.40	$ 870.40	$ 43.00
1922	946.67	1,152.00	205.33
1923	456.07	599.20	143.13

The average Mid-Continent compression plant produces about 2350 gallons of gasoline per day, or about 107 carlods per year. Hence, in 1921 the compression manufacturer would have made about $4600 more by shipping his product raw than he would have by blending. Chart number two (which compares the monthly average quotations of raw-compression gasoline with motor natural blends) shows that during 1922 raw-compression gasoline commanded a premium of 1.72 cents a gallon over average motor natural blends. Yet, in spite of the "greater extractive efficiency" of the blending process its utilization during 1922 would have cost (or caused) the compression plant owner a loss of about $22,000 and in 1923 about $15,000.

The above conclusions are based on the assumption that either one process or the other would have been used throughout the entire three-year period. A further study of chart number two shows that blending was highly profitable during five months of 1921—when viewed from a comparative price basis. It also shows that blending was profitable during five months of 1923—and not profitable at any time in 1922. In other words, blending was profitable for only ten months out of the past three years. A business whose physical equipment and operating policy is such that it is profitable for such a small fraction of the time can hardly be called a "safe" business—especially when a different operating policy can so greatly increase the earning power of the invested capital.

A study of chart number five dealing with New Navy and Motor Natural Gasoline shows that 58-60, 437 end point New Navy Gasoline sold at an average price of about seven-tenths of a cent a gallon above 64 gravity motor natural. One would expect that of the two, the higher gravity fuel would command the higher price, but price history in this instance records the opposite. There are several reasons for this: (1) The volume of motor fuel produced by the average natural gasoline manufacturer is small by comparison with that put out by the average refiner, who has a larger and better sales organization and therefore obtains a higher price for his product. (2) Motor natural blends, as at present manufactured, contain a small percentage of the fixed gases, propane and ethane, which increase the evaporative tendencies of this fuel to the point where losses by evaporation from this product are considerably greater than in the case of New Navy. (3) The naphtha used in manufacturing motor natural blends has an end point of 450 to 460—consequently, the resulting motor fuel has an end point approaching 450 degrees, or about 13 degrees above average New Navy. In other words, the lower end point motor fuels nearly always command a higher price. In further proof of this statement one need but compare the weekly quotations of 56-58, 450 end point Domestic gasoline with New Navy and then compare New Navy with 375 end point export. (4) The average filling station owner is prejudiced in favor of New Navy. These facts can only further strengthen the argument against the compression-blending process. The elimination of the compression-blending process as a profit maker leaves the choice between the compression and absorption process.

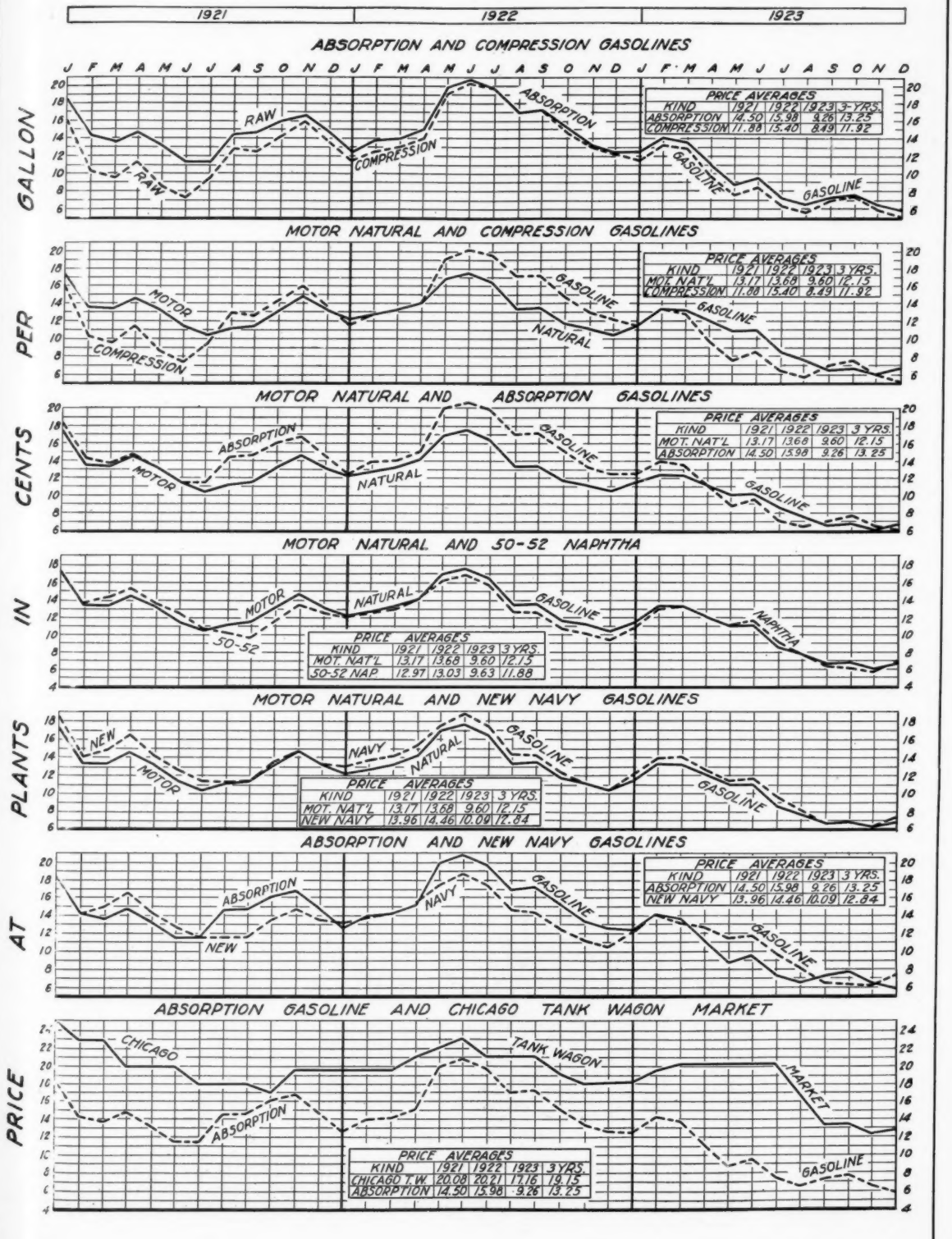
Working Capital

The compression blender must handle two cars of naphtha into his plant and three cars of motor natural blends out of his plant (or a total of five cars) as compared with but one car of straight compression made gasoline. This means that the compression-blender must increase his working capital proportionately in order to handle the extra purchases, sales and equipment account. Interest and dividends must be paid on the entire investment—and this includes working capital as well as plant investment. Anything which lessens the amount of necessary working capital without, at the same time, sacrificing income will increase the dividend earning power of the entire investment, and release for further useful power of the entire investment, the excess working capital needed by the compression-blender.

Experience has demonstrated that the absorption process, (when properly installed and operated,) (1) produces more gasoline; (2) produces better gasoline; (3) treats gases containing air successfully; (4) treats lean gases which cannot be treated by compression; (5) can be operated at less expense; (6) produces a more marketable

(Continued on page 18)

COMPARATIVE GASOLINE PRICES


1921
1922
1923
ABSORPTION AND COMPRESSION GASOLINES
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
GALLON
RAW
RAW
COMPRESSION
ABSORPTION
GASOLINE
GASOLINE
PRICE AVERAGES
KIND | 1921 | 1922 | 1923 | 3 YRS.
ABSORPTION | 14.50 | 15.98 | 9.26 | 13.25
COMPRESSION | 11.88 | 15.40 | 8.49 | 11.92
MOTOR NATURAL AND COMPRESSION GASOLINES
PER
MOTOR
COMPRESSION
GASOLINE
NATURAL
GASOLINE
PRICE AVERAGES
KIND | 1921 | 1922 | 1923 | 3 YRS.
MOT. NAT'L | 13.17 | 13.68 | 9.60 | 12.15
COMPRESSION | 11.00 | 15.40 | 8.49 | 11.92
MOTOR NATURAL AND ABSORPTION GASOLINES
CENTS
ABSORPTION
MOTOR
NATURAL
GASOLINE
GASOLINE
PRICE AVERAGES
KIND | 1921 | 1922 | 1923 | 3 YRS.
MOT. NAT'L | 13.17 | 13.68 | 9.60 | 12.15
ABSORPTION | 14.50 | 15.98 | 9.26 | 13.25
MOTOR NATURAL AND 50-52 NAPHTHA
IN
MOTOR
50-52
NATURAL
GASOLINE
NAPHTHA
PRICE AVERAGES
KIND | 1921 | 1922 | 1923 | 3 YRS.
MOT. NAT'L | 13.17 | 13.68 | 9.60 | 12.15
50-52 NAP. | 12.97 | 13.03 | 9.63 | 11.88
MOTOR NATURAL AND NEW NAVY GASOLINES
PLANTS
NEW
MOTOR
NAVY
NATURAL
GASOLINE
GASOLINE
PRICE AVERAGES
KIND | 1921 | 1922 | 1923 | 3 YRS.
MOT. NAT'L | 13.17 | 13.68 | 9.60 | 12.15
NEW NAVY | 13.96 | 14.46 | 10.09 | 12.84
ABSORPTION AND NEW NAVY GASOLINES
AT
ABSORPTION
NEW
NAVY
GASOLINE
GASOLINE
PRICE AVERAGES
KIND | 1921 | 1922 | 1923 | 3 YRS.
ABSORPTION | 14.50 | 15.98 | 9.26 | 13.25
NEW NAVY | 13.96 | 14.46 | 10.09 | 12.84
ABSORPTION GASOLINE AND CHICAGO TANK WAGON MARKET
PRICE
CHICAGO
ABSORPTION
TANK WAGON
MARKET
GASOLINE
PRICE AVERAGES
KIND | 1921 | 1922 | 1923 | 3 YRS.
CHICAGO T.W. | 20.08 | 20.21 | 11.16 | 19.15
ABSORPTION | 14.50 | 15.98 | 9.26 | 13.25

Model Plant Has Many New Features

Mechanical arrangement made with idea of simplification in California plant

By W. H. Hile, Jr.

THE absorption plant recently completed at Santa Fe Springs, Los Angeles, California, for the United States Refining Company possesses many features of particular interest to engineers and casing head gasoline manufacturers.

The plant has a rated capacity of fifteen thousand gallons of gasoline per day, but under overload has produced as high as 23,000 gallons of gasoline daily.

The flow through the plant briefly is as follows: The gas is brought to the plant in a 15-inch steel pipe line, passing first to an accumulator, then through a gas cooler, thence to a second accumulator tank for the removal of distillate and heavy oils.

The gas then passes through four absorption towers, four feet in diameter by 60 feet high, which are filled with wooden baffles. The gas in its upward passage through the towers is robbed of its gasoline content by the absorption oil filtering down through the tower over the baffles.

The absorption oil when it reaches the bottom of the tower has been enriched with from three to five per cent of gasoline. The rich or gasoline carrying oil passes to heat exchangers, where it meets the returning hot lean or stripped oil from the still. The enriched oil then passes to a pre-heater, heated by steam under pressure and thence to an evaporator where the gasoline is stripped off.

The gasoline vapors are cleaned from the absorption oil, etc., in a dephlegmator having an oil cooled control section, thence going to a gasoline condenser the product from which is a water white, 25 plus color gasoline, of 70-72° Be. gravity.

After passing through a separator to remove the water and through a look box, the gasoline flows to the run down tanks and thence to storage.

The hot lean or stripped oil from the still goes to the heat exchangers flowing counter current to the cold fat oil, thence to water cooled oil coolers, from which it is pumped to the top of the absorption towers.

This plant was designed and built by the Southwestern Engineering Corporation of Los Angeles, under a guarantee as to the operating results, which the purchasers say have been exceeded from the start.

The equipment installed is to be noted for the high heat exchange efficiency, operating results and the fact that large capacity equipment has been built into a minimum of space.

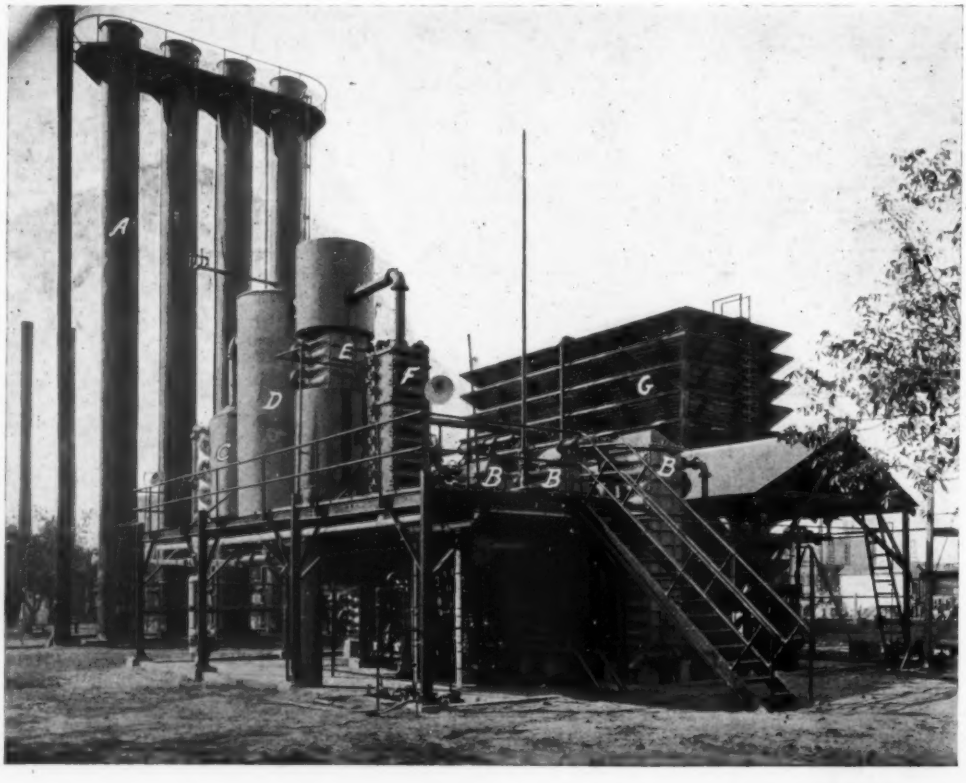
Tests showing high percentages of gasoline extracted—due to the method used in the evaporator, where the enriched hot oil is spread over large surfaces and swept continually with high velocity vapors and steam. This method strips the oil of its gasoline, to an initial boiling point of 346° F. for the lean oil—nearly the specified end point of the gasoline itself.

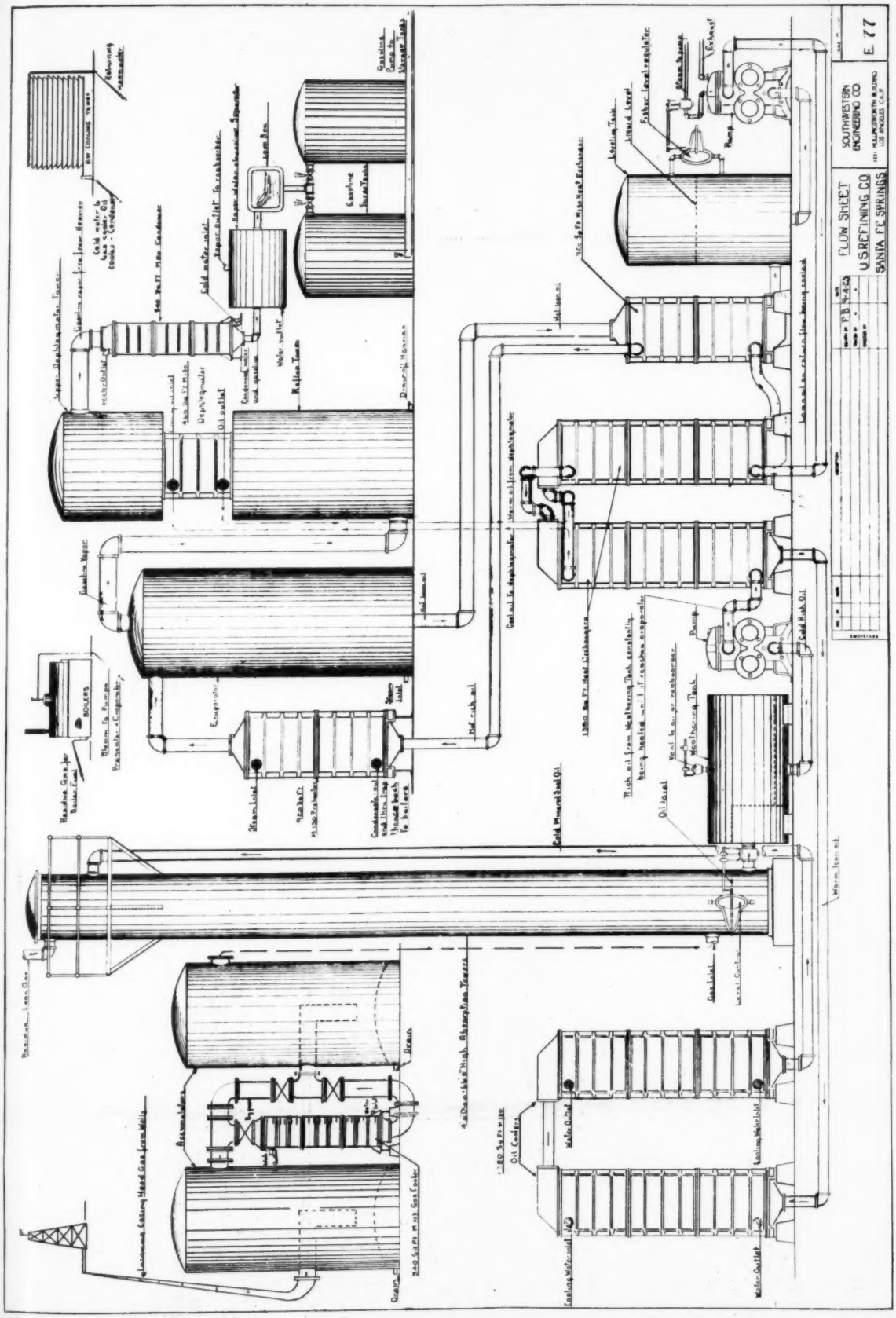
The absorption oil entering the towers shows an initial temperature of 346° F. with five per cent over at 523° F. and a maximum temperature of 650° F. This is accomplished at an expense of less than 15 per cent of open spray steam, subsequently separated from the gasoline ahead of the look box. Dephlegmator bottoms separate without evidence of emulsion.

Production for the first sixteen days operation of the U. S. Refining plant was 270,237 gallons from 374,500,000 cubic feet of gas (eighty per cent of the recoverable gasoline in the gas).

The flexibility of the plant was demonstrated by the fact that, for much of the time the plant was overloaded until more than 150 per cent of its rated gasoline capacity was being produced, with little loss in efficiency. Operation was continuous during this overload period, and no difficulty was experienced in maintaining either end point or color of the product. Under normal load this plant recovers more gasoline than that shown by the Newton tester.

A feature of this plant was the painting of the apparatus of the plant in various colors, corresponding to a posted




FLOW SHEET
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SANTA FE SPRINGS
SOUTHWESTERN ENGINEERING CO
E. 77
BOILERS
Pump
Pump
Pump

explanatory legend. This familiarizes the operators with the working scheme, as well as gives the plant a finished appearance.

Careful placement of boilers at distances from gasoline lines and containers has removed much of the fire hazard.

The gasoline condenser is of particular interest. It is three feet square by eight feet ten inches high. Gases, vapors and liquids to be cooled or condensed enter the top of the apparatus and flow down over and outside of the horizontal tubes.

Continuously during the flow, the vapor being cooled is deflected and broken into minute particles by the great force with which it strikes the staggered tubes, insuring intimate contact between the particles being cooled and the cooling surface, and absorbing much of the light vapors that have not been condensed. The finished product flows out by gravity in a continuous cool stream.

Tubes are grouped in the horizontal units, each unit having a return cover plate, which is bolted to the tube sheet face. Ports communicate with the water jacket and provide for circulation of water through the tubes. Carefully machined surfaces and gaskets make excellent water tight joints and allow small sections of the tube-sheet surface to be exposed without interfering with the continuous operation of the balance of the condenser.

In this three section condenser there are nine units, with nine inlet and nine outlet valves; allowing a number of circulating combinations. It is possible also to circulate oil in the upper units and transfer the heat ordinarily absorbed by the cooling water to the oil that is flowing to the still. This adaptation is useful in continuously operated stills.

The Southwestern Engineering Corporation recommends its valveless condenser for general use and particularly when oil is used as the cooling medium. The Southwestern Condenser is unique in that it offers the possibility of circulating more than one cooling medium at the same time in one apparatus. The route of the oil can be changed to series, parallel or series parallel-flow by the insertion of "stops" or "plates."

The three section condenser is only three feet square and eight feet ten inches high with an internal volume of 33 cubic feet and 540 square feet of cooling surface.

The condenser stands vertically, requiring but little floor space. The condensate drops from tube to tube and is thoroughly cooled, preventing re-evaporation of gasoline, and facilitating solution and retention of the more volatile hydrocarbons. The cooling tower effect of the Southwestern Condenser insures both complete condensation and a cool condensate. Ordinarily condensation occurs in the upper half of the condenser, the lower half serving mainly to cool the condensate and to condense the lighter vapors. The shower of condensate coming down against the light vapors tending to rise gives the absorption tower effect. The vapor passage is encased completely in a water jacket, adding materially to the cooling surface. Materials from which the condensers are made are chosen for their efficiency and long life. Water jackets, tube sheets, cover plates and bonnets are of semi-steel, while the tubes are of Admiralty metal, which has high heat conductivity and long life under corrosive actions.

Refiners will be interested in a booklet called "Buying Rust Protection," recently published by the Eagle-Picher Lead Company. Corrosion is discussed in this booklet and considerable statistical information is given concerning paints. Copies can be secured by writing The Eagle-Picher Lead Company, 208 S. La Salle St., Chicago, Illinois.

Drop forged steel fittings and valves are described in a new catalog published by the Henry Vogt Machine Company, Louisville, Kentucky. The catalog gives specifications and prices on all fittings made by the Vogt Company. These include: drop forged steel ells, steel tees, steel crosses, steel globe valves, steel angle valves, steel horizontal check valves, "Y" valves, steel flanges, couplings and bushings. Copies of the catalog may be secured by writing Henry Vogt Machine Company, Louisville, Kentucky.

A new circular has recently been issued by the A. Y. McDonald Manufacturing Company, describing their Universal Gastite dome cover. This circular shows the application of the dome cover and has a chart showing statistics on what has been accomplished by using the dome cover. Copies of the circular can be obtained by writing the A. Y. McDonald Mfg. Company, Dubuque, Iowa.

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McDONALD

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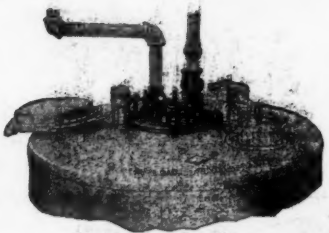

Universal Gastite Dome Cover

Tank Vent

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The A. Y. McDonald Company is the world's largest maker of swing joints, as well as one of the largest makers of other oil handling equipment.

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Our UNIVERSAL GASTITE DOME COVER, for preventing evaporation losses while loading casinghead or absorption gasoline, is meeting with wide favor. This cover also effects saving when loading ordinary gasoline.

These are only a few of the interesting items in the complete McDONALD line. Allow us to send you our Oil Equipment Catalog.

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"The PIONEERS in Offering Complete Bulk Station Equipment"

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Comparing Gasoline Plant Operating Costs

(Continued from page 14.)

product; (7) produces a gasoline which commands a higher price than compression made products.

Statements 2, 6 and 7 are amply proved by the comparative prices of compression and absorption gasolines for the years 1921-22-23 as reflected in chart number one. This chart shows that during 1921 absorption gasoline sold for an average of 2.62 cents a gallon more than compression, and that it commanded premiums of 0.58 of a cent in 1922 and 0.77 of a cent in 1923. It goes without saying that a competitive product which sells for more money must be a better product and more marketable, otherwise it could hardly maintain its price position.

A properly designed, constructed and operated oil absorption plant eliminates all of the loss of gasoline to the residue gas which occurs in the operation of practically all compression plants. Therefore, the net production of the average compression plant (2.90 gallons) can be increased to 3.30 gallons per thousand by saving the 0.40 of a gallon of gasoline that the average compression plant loses. This increase in production amounts to about 14 per cent. Practical experience with converted plants, however, has shown that the net production will be increased by about 20 per cent on account of reductions in evaporation, weathering, transfer, loading and outage losses. Hence, if we add 20 per cent to the 2.90 gallons net sales of the compression plant, we obtain a net of 3.48 gallons per thousand for the absorption plant. Therefore, the same gas which produces 8000 gallons in the average compression plant will produce 9600 gallons in a properly designed and properly operated oil absorption plant. The following table shows what was received for this amount of absorption gasoline during the years 1921, '22 and '23.

Comparative Net Sales From Oil Absorption Plant

	Gals.	Price	Gross Sales	*Net Sales
1921	9,600	@14.50c	$1,392.00	$1,296.00
1922	9,600	@15.98c	1,534.08	1,438.08
1923	9,600	@ 9.26c	888.96	792.96

*Net Sales equal gross sales less ½c per gallon for Tank Car rentals and ½c for sales overhead, or a total of $96.00 per car.

By comparing these net sales from the straight compression made product we find differences in favor of the absorption method of $425.60 for 1921; of $206.08 for 1922 and of $193.76 for 1923. On 107 shipments per year these increased earnings would have totaled about $46,000 in 1921, $31,000 in 1922 and $21,000 in 1923. And these potential profits could have turned into real profits had the owner converted his compression plant to the oil absorption process. Expressed in percentages these figures represent in gross earnings of 49 per cent for such a year as 1921—of 25 per cent for 1922 and 34 per cent for 1923—the average for the three years being 36 per cent. What effect an average increase of 36 per cent in gross earnings would have upon net earnings will be left to the reader's imagination.

A similar comparison with the gross returns of a compression-blending plant shows increases for the three years of $468.60, of $491.41 and $336.89 per shipment in favor of the absorption process, or yearly increases in gross earnings of $50,000 (57 per cent), $53,000 (52 per cent) and $36,000 (74 per cent), or a three year average of 61 per cent. Chart number four graphically compares the records of prices at which raw absorption gasoline and motor natural fuels have been sold during the past three years and helps one to visualize the economic superiority of the absorption process over the compression-blending method.

Absorption Superiority

In the final analysis a gasoline plant is built for the same reason that any other manufacturing plant is built: to earn a substantial income on the money invested. And if the yardstick of better quality and larger quantity, of greater marketability and larger profits is laid down beside the three methods of making gasoline, it will be found that the oil absorption process has amply demonstrated its claims for superiority over all other processes.

The natural gasoline manufacturer is interested not only in comparisons which deal with the market values of raw absorption, raw compression, motor natural and new navy gasolines and naphthas, but in the question of natural gasoline sales contracts. Therefore, in order that all of the price data in which the natural gasoline manufacturer is interested may be presented on one sheet, the writer has appended charts six and seven dealing with comparisons between Absorption and New Navy Gasolines in one instance, and Absorption Gasoline and the Chicago Tank Wagon Scale in the other.

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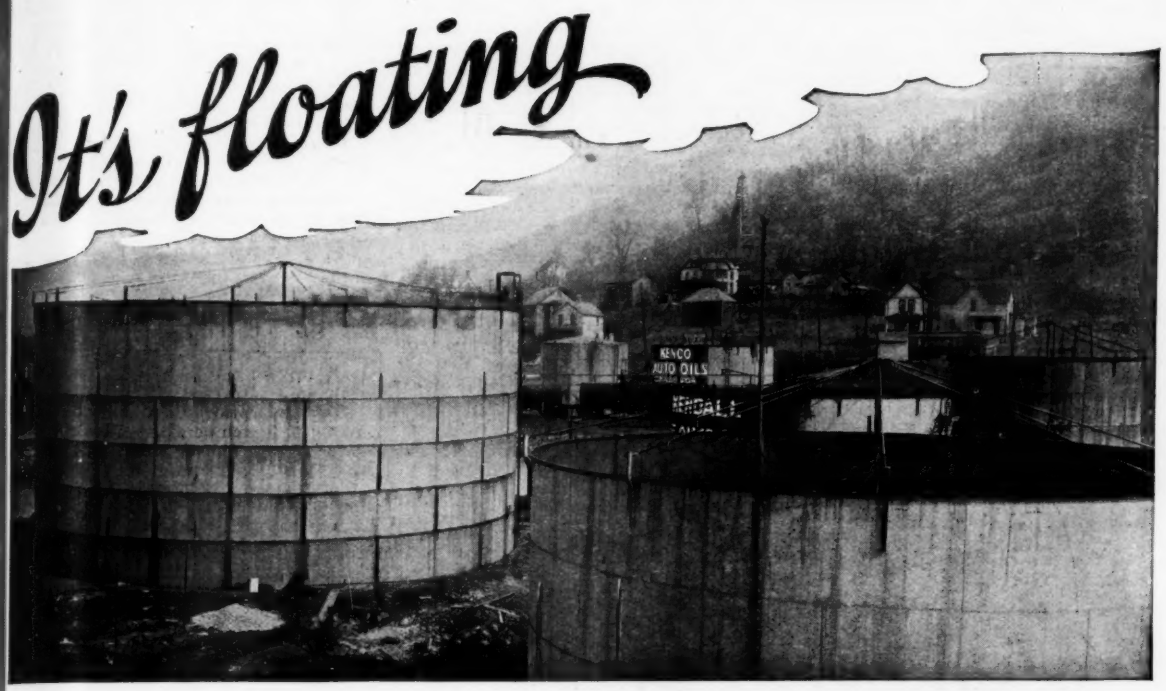

Check Up on Its Performance

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Burkesville, Ky. Beaumont, Tex. Los Angeles, Calif.
Wichita Falls, Tex. San Francisco, Calif.

Send your engineers to investigate. We'll gladly furnish exact locations and names of owners. See it floating on tanks ranging from 20-foot run-down to 55,000 bbl. storage. See it on old tanks, on new tanks and on rebuilt tanks. See it on New Navy Gasoline, on fuel oil and on crude. See how it prevents fire. Get first hand facts on how it prevents evaporation.

For instance, at Kansas City, the K. C. Refining Co. will show you their own figures on the storage of 25,000 bbls. of New Navy Gasoline, 102 hot, windy days with a shrinkage of less than 1%.

It's a noteworthy fact that an engineer's investigation is followed by a Safvety Deck installation. It's a noteworthy fact that others quickly follow until all tanks are proofed against fire and evaporation. Witness the partial view of the Kendall Refining plant above. Eight Safvety Decks are now installed. Ten others are installed in the same city at the Bradford Refining Co. plant, Bradford, Pa.

By all means, send your engineers. In the meantime we'll send complete catalog. It reproduces photographs of installations, results of actual tests, letters from users and full details of construction. Look into this now before there is a waiting list for installations. What's your address?

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PREVENTS OIL TANK FIRES and EVAPORATION

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Cooling Condensing Water a Problem

(Continued from page 12.)

cooling water is charged with salt, evaporation and concentration may even go so far as to give a briny taste, which indicates an excessively high salt content. The only remedy is to drain the cooling system at regular intervals; water so drained may be used for washing oil.

Where boilers take water from the concentrated water of a cooling system, steaming and scale troubles ensue.

In the refinery with several batteries of stills, running light oils down, the light vapors of gasoline require water for cooling with lower temperature than the naphtha, kerosene, and lower distillates require. The initial boiling point of gasoline from the lightest vapors depends upon the condensing water temperature and, to prevent loss of these vapors, condensing water must be lower in temperature than the final worm temperature. When water goes into the bottom of the box at 110° F., the fractions condensing below 110° F. are not condensed; more often during the midday of summer, condensing water goes on at higher temperature. The coil is some 10 to 20 degrees higher than the exterior water temperature or more. Of course, the bottom of the worm is covered with the coldest water and it is this temperature that reduces gasoline to the run down temperature. If water is pumped into the bottom of the box at atmospheric temperature or higher, it follows that the vapors and condensate have higher temperature, since it is extremely difficult to pass sufficient water over the coil to reduce the condensate temperature to anything like that of the water; the movement of water, circulation, over the coil is very slow, so that the rate of heat transmission is also extremely low.

Running crudes of low initial boiling point, especially when produced from the wells into vapor proof tanks, high condensing water temperature causes a loss of the fractions sought by the use of such tanks.

As a regular practice in refining low initial crudes, cooling water could be profitably divided into a supply for the heavier streams and a cooler supply for the lighter, with cooling for the latter performed separately and especially for securing the lowest commercial temperatures.

The absorption plant deals with lower average temperatures than the refinery, since the product has a lower average boiling range, and cool water is especially necessary for summer work to prevent loss of recoverable fractions into tail gas. Water cooler than atmosphere is especially desirable for the condensers to recover fractions that are wild; incoming wet gas drops out its moisture down to the temperature to which it is cooled and, if the temperature is not further lowered when the gas is passed through the towers, no further precipitation of water vapor in the wet gas occurs, which avoids emulsification due to water gathering in the oil passing through the tower; compressor and vacuum pump capacities are increased by cooling the inlet gas as shown by table in figure 10. Then, for gasoline plant work, whether absorption or compression, an efficient cooling system is necessary for maximum results.

Not all troubles in condensing are from cooling water, however, since if the coils are covered with scale, blanketing them against heat travelling outward, the rate of transmission is materially reduced. Some coils show rates of transmission as high as 250 B.t.u.'s per square foot per degree difference in temperature between water and vapor, but the average rate is not more than one fourth the above, due to scale and circulation being very slow in the average condenser box. Heat is transferred more rapidly when the surface is swept rapidly; the lowest rates are secured when water is comparatively still; the highest rate when water is circulated in unlimited quantities over the surface.

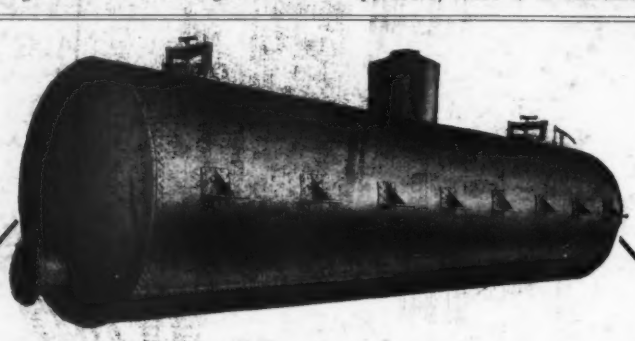
Then a lower average temperature of water in an entire cooling system with subsequent lower temperature of condensate may be secured by circulating the same quantity of water more times in a given period through the system.

HIGH TEMPERATURE

High temperature heat insulation is the subject of a bulletin published by the Philip Carey Company.

This bulletin is especially valuable on account of the numerous tests described in it. Each test includes graphs showing results and from these results deductions are made regarding high temperature insulation.

Copies of the bulletin may be secured by writing The Philip Carey Company, Lockland, Cincinnati, Ohio, and asking for bulletin No. 101.



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are double riveted throughout. One piece head-flanged and dished. Fire course is one sheet of still bottom steel. Shells built with **four seams horizontally—NO ROUNDABOUT SEAMS**, offering less possibility of leaks. Lugs are our design of built-up steel plate.

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It Will Mean—

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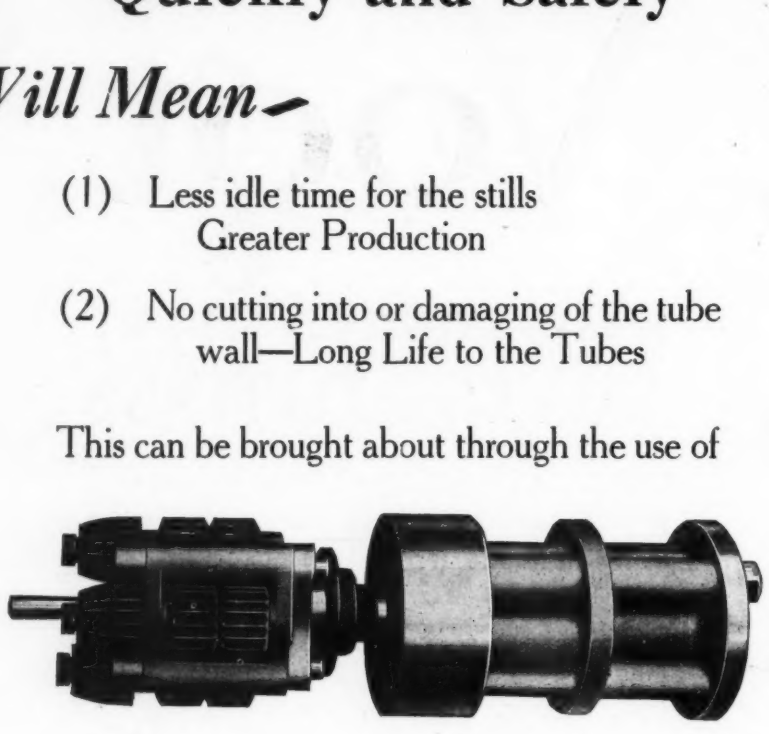

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California Tendency Toward Better Yields

Economic conditions hasten development of processes and methods for low cost production

By Carl J. von Bibra
Chemical Engineer

California refiners are looking toward increased operating efficiency and improved technique for relief from the situation which confronts the industry as a result of past months of excess crude supply.

The accompanying article is the second of a series dealing with refinery operation on the West Coast.—The Editor.

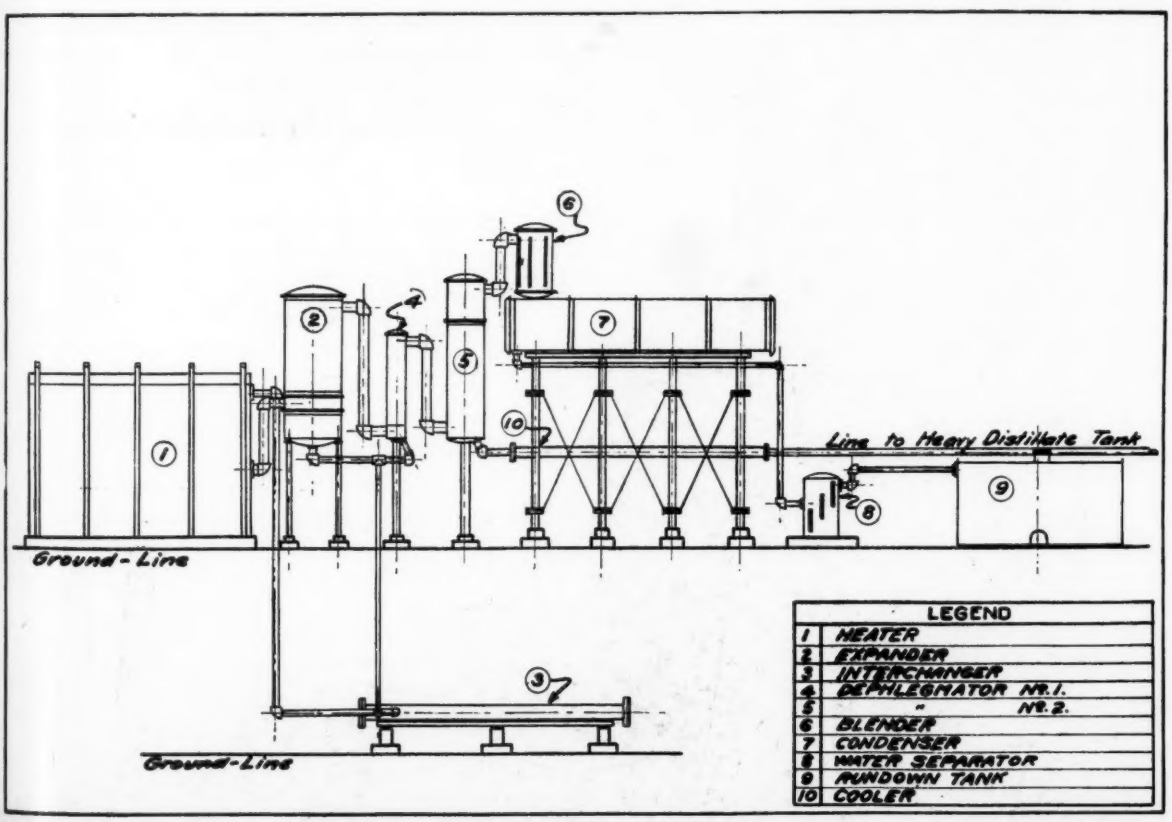
WITHIN the past 10 or 15 years a great change has taken place in the systems of distillation used in representative oil refineries in California. This change is still going on, although at the present time a very high efficiency has been developed in distilling operations.

Use of Cylinder Stills

The conventional form of apparatus universally used until recent years for the distillation of crude is the cylinder still. This still consists of a steel shell mounted horizontally over a brick setting and fire box. It is provided with open coils through which steam is injected into the hot oil contained in the still. Heat is supplied by a fire under the still, and this, together with the slight heating effect of the steam and the partial pressure condition produced by the latter, removes the lighter vapors from the body of oil, carrying them up into a dome riveted to the upper side of the horizontal cylinder. This dome is conventionally placed near the middle of the still, and from it leads a vapor line which transports the vapors and steam from the still into a condenser. The form of condenser generally provided for the still just described consists of many runs of pipe connected with return bends and immersed in a box of water. From the outlet of the condenser the condensate and water are run through a look-box from which the operation is controlled. The look-box shows the size of the stream coming from the still, proportion of steam to oil vapor being used, the color of the distillate and its other characteristics, such as gravity and distillation range, which can be determined by samples conveniently taken at this point.

Modifications of this simple type of horizontal cylinder still have also been used from time to time. The well known cast iron cheese-box is an example. In form this is a vertical cylinder with a conical upper head.

The cylinder still has many advantages. It is a very flexible piece of apparatus and can consequently be readily handled by more or less inexperienced operators. It is very convenient for the fractionation of small quantities of crude. When large quantities of crude are to be handled for a long period of time, a number of cylinder stills can be connected into a continuous system. Where such a continuous system is arranged so that a light distillate is topped from the incoming crude in one still and the residuum, without cooling, is allowed to overflow into another still where a second cut is removed, and so on down through a number of stills, we have



The above illustration shows a simple type of tubular continuous distillation apparatus recently constructed in California. This unit is small, having a capacity ofonly 1500 barrels a day, but shows clearly the trend of development in this type of distillation plant. One interesting novelty in this particular plant is the Blender (Fig. 6.) High gravity compression gasoline is sprayed into this Blender through fine nozzles.. This serves a double purpose, aiding in the condensation of the gasoline produced from crude and at the same time producing a very intimate blend.

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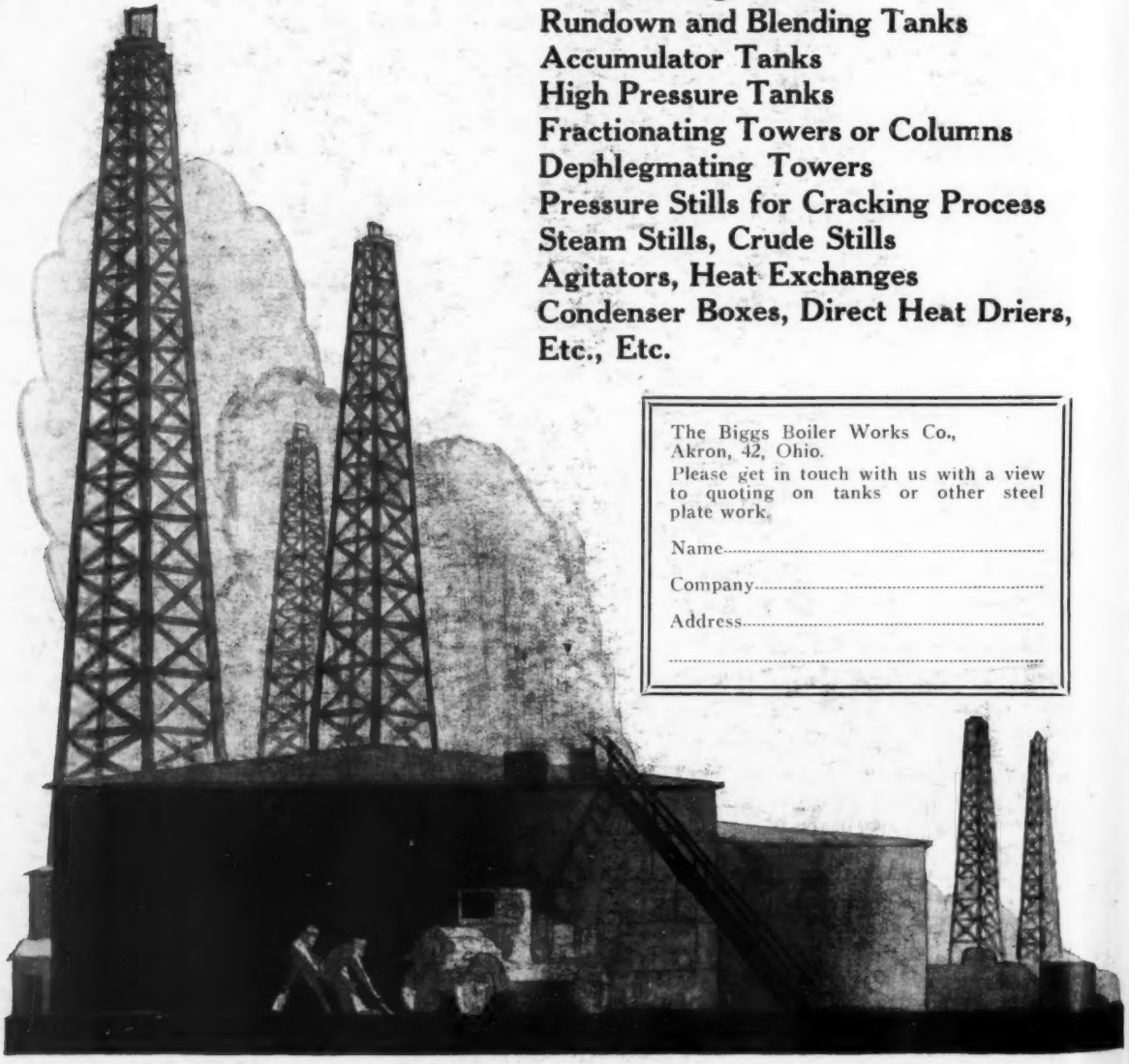

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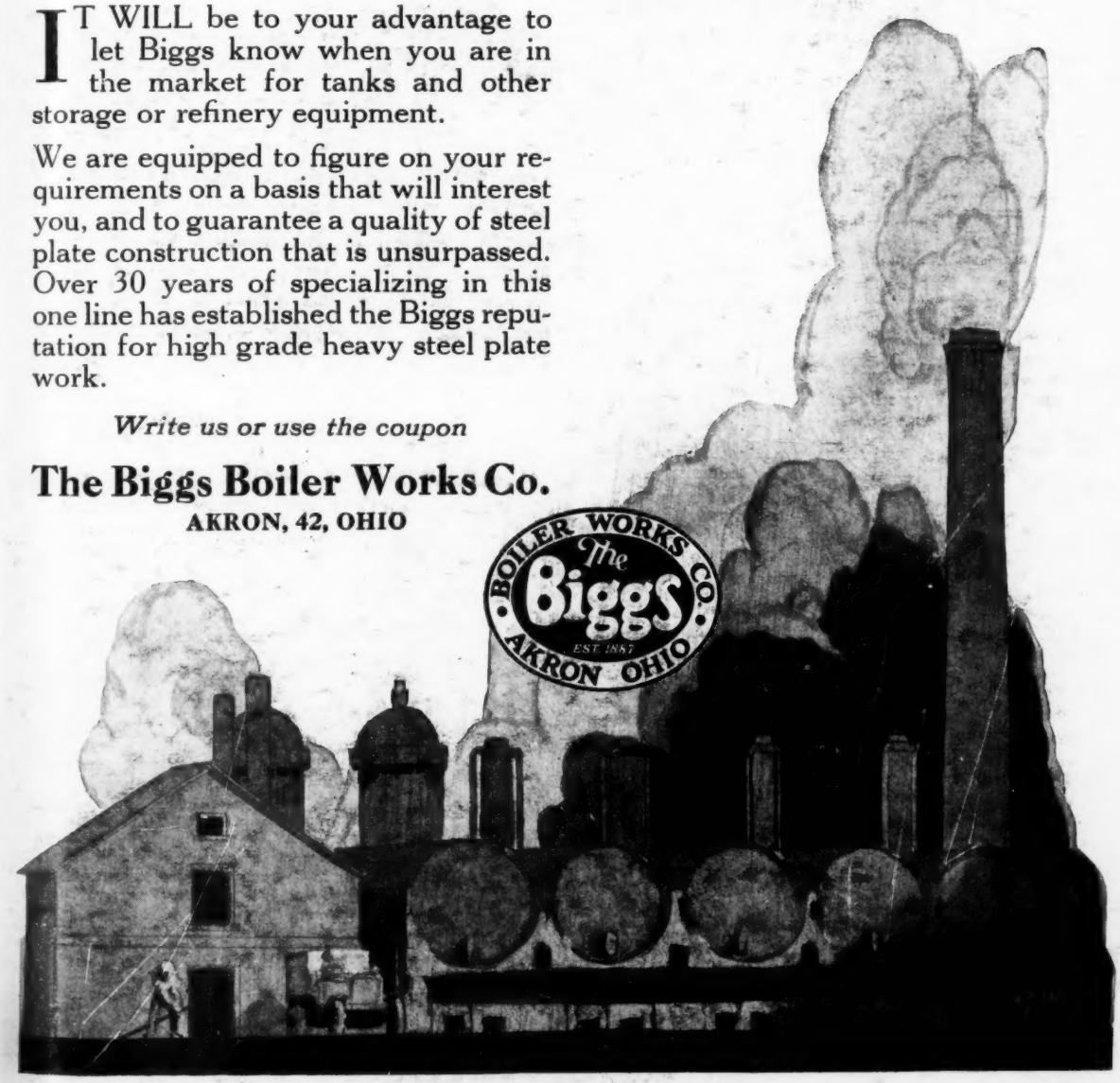

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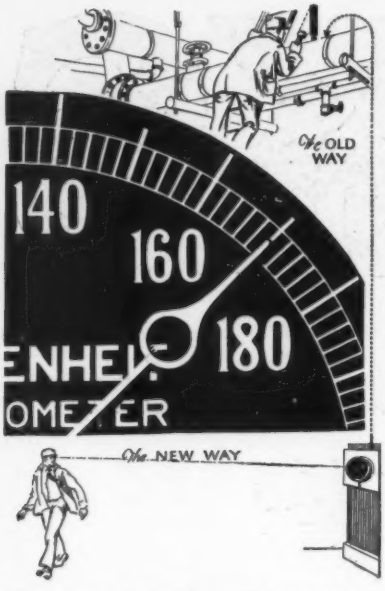

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what is known as a Russian set. This is a system of distillation widely used in Russia and developed in that country. It is efficient and flexible. For the production of certain cuts, such as lubricating distillate, it is hard to improve upon.

One difficulty met with in the use of cylinder stills is that they do not readily handle oil with a large percentage of water, mud, emulsion or similar disturbing constituents of some crude oils. Of course it is possible to so design cylinder stills that they will not be affected by the above mentioned impurities; for instance, a still built to withstand a pressure of 100 pounds per square inch will, when equipped with vapor outlets of ordinary dimensions, handle any wet oil. The danger of burning out still bottoms which is caused by mud from fresh crude settling in the still can also be obviated by periodical scraping. However, the extra construction and operating costs incidental to the solving of the above mentioned difficulties makes it economical to adopt tubular distillation systems for the handling of refractory oils.

For the distillation of pipe line crude, i.e., oil containing not more than three per cent m. and b.s., continuous batteries of cylinder stills are on the whole quite satisfactory. They were used by all California refiners 15 years ago and are still used by some of the largest companies.

For the re-running of tops or more closely cut distillates, steam stills of the horizontal cylindrical type are practically ideal. These stills, like the cylindrical crude stills, consist of steel shells supported horizontally. Instead of being provided with a fire box and setting for external heating, they are heavily lagged and heated by both open and closed steam coils. The steam is generally superheated. As steam stills are used for close fractionation, they are provided with dephlegmators or rectifying columns which will reflux back into the still and thus in effect doubly fractionate the oil. That is, a fraction is removed from the body of oil in the still and leaves the still in the form of vapor; this vapor is then fractionally condensed in the dephlegmator and the heavy portions of it passed back into the still to be redistilled. Unlike the steam still, the cylindrical crude still is not always provided with dephlegmators because those commercial fractions produced by it which must meet exact specifications are almost invariably re-run in a steam still or some other form of reducing still.

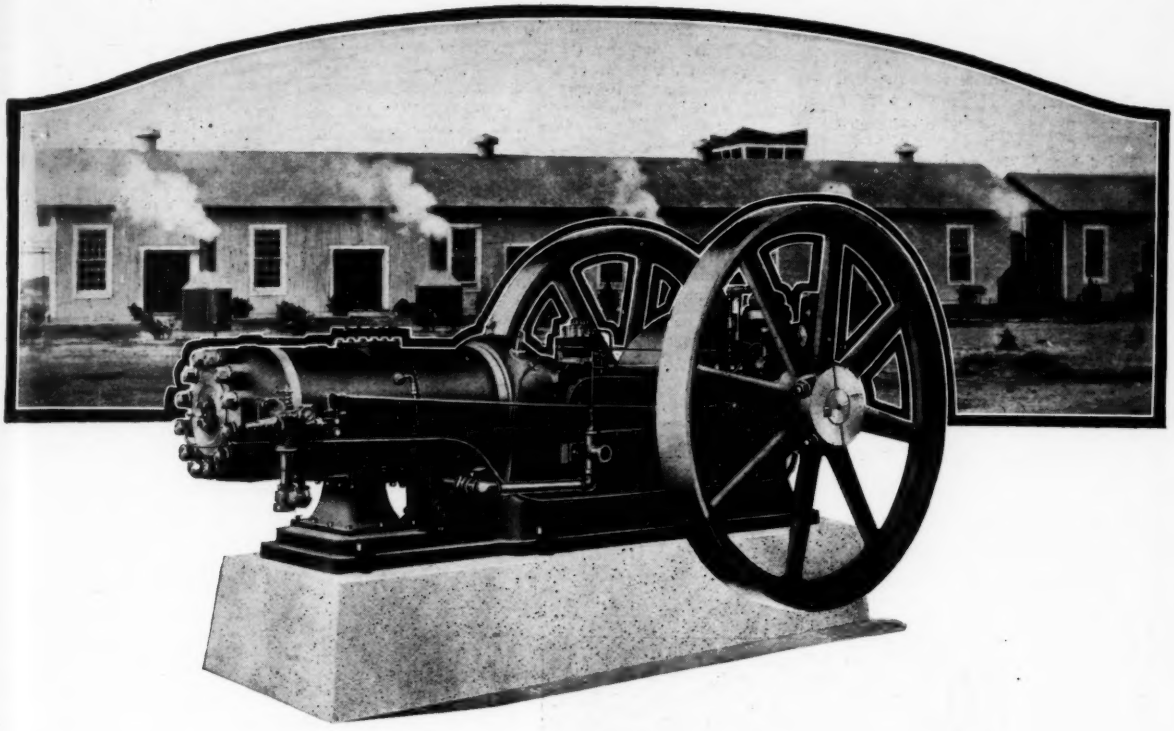
We have discussed the use of single cylinder stills for the distillation of small quantities of oil and the use of batteries of these stills for the continuous distillation of large quantities of oil. There is another method of operating cylinder stills. This is by so called semi-continuous distillation. Semi-continuous distillation can be carried out in one still or in as large a number of stills as may be desired. The essential feature of the arrangement is to keep on adding fresh crude or other charging stock to the still as the lighter portions are distilled off. No residuum is drawn off until the still, or battery of stills, is shut down. This system of distillation finds application in cases where it is desirable to put a large amount of crude through a still or group of stills arranged for intermittent operation, and where it is not possible to arrange for the continuous system. It is also valuable where it is desired to accumulate as large as possible an amount of the heavy end of the oil being run; for instance, in the handling of asphalt base crude the refiner may wish to obtain a batch of asphalt of a definite specification. If the quantity required is 400 barrels and only one 500 barrel still is available for the purpose, it would be necessary to charge this still four times with crude containing about 25 per cent asphalt to produce the required amount. However, if the still were charged and additional crude run in as the distillation progresses, it would not be necessary to shut the still down and go through all the rountine of switching run tanks for each individual run. The distillation would be continued until the required 400 barrels of asphalt is all that remains in the still. Furthermore, the specifications of this asphalt could be very carefully met by operating with the larger quantity instead of by running each of four batches to specification and then blending.

Cylinder Stills With Boiling Coils

One of the first departures in California from the conventional cylinder still was the use of cylinder stills with so called "boiling coils". This arrangement differed from the ordinary cylinder still in just one way, but this one difference was very important. Instead of having the oil inlet of the still flush with its inner wall and thus having the cold oil (or moderately pre-heated oil) come into immediate contact with the hot oil in the still, the incoming crude or other oil was passed through a long coil of pipe submerged in the body of oil in the interior of the still. The results obtained with this arrangement were particularly excellent when wet oil was being charged. By having the wet oil entering the still pre-heated at the temperature of the oil in the body of the still, the mater contained in the oil was slowly evaporated and released into the body of oil in the still in the form of steam. By being released in this form it aided in the distillation. In the ordinary form of cylinder still the cool, wet oil is introduced suddenly into the hot oil, and any water which it contains is instantaneously converted into steam. This sudden evolution of steam causes the still to foam over. This foaming is often very serious. The writer has on many occasions (several of them experiences of his own) seen completely charged stills start foaming and not stop until the entire contents had emptied itself through the vapor line, condenser, run tanks, and the ground around it!

In addition to removing the danger of foaming, the use of boiling coils made it possible to greatly increase the capacity of cylinder stills without entirely reconstructing them. This increased capacity naturally varied with the nature of the crude being handled, but in several California plants was between 200 and 300 per cent of the capacity of the stills before boiling coils were installed.

It is obvious that if such a desirable effect could be obtained by discharging a highly heated oil into a cylinder or chamber from which it is evapo-



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rated or rather released in vapor form, that this effect can also be obtained, with a higher thermal efficiency, by heating the oil in a tubular coil directly heated by combustion gases in a furnace instead of being heated by a body of oil which in turn has been heated through a single steel shell exposed to furnace heat. The next step in the development of an economical distillation system was, therefore, a combination of pipe still and cylinder still. The incoming crude was passed through a pipe coil directly heated by a furnace. This pipe coil discharged into a horizontal cylinder still, in which the distillation was continued. This was a great advance over all previous systems but still had its weaknesses; for instance, if an oil containing considerable mud was handled, the mud would pass through the pipe still without any difficulty, provided the velocity was sufficiently high, but when it got to the cylinder still it would settle to the still bottom and cause local superheating, with the consequent weakening of the shell and eventual burning out of the still bottom. Also the amount of heat required to distill a given quantity of oil in the pipe still was practically half that required in distilling the same quantiy of oil in the cylinder still. This being the case, why not do all the distilling in the pipe still? This in fact was the next step in the development of the distillation systems now principally used in California.

Early Tube Stills

About the same time that boiling coils were being experimented with, one very large California company whose chief engineer had been a steam boiler expert before entering the oil business, started a new line of development by distilling oil in field boilers which had been condemned for high pressures. Very good thermal efficiencies were obtained, and dirty oil could be handled quite satisfactorily.

The use of condemned boilers for oil distillation has grown from year to year, and there are now a number of plants, large and small, using this type of apparatus.

The use of pipe stills in oil distillation was at first limited to topping plants. For this purpose pipe stills were quickly recognized as being ideal. Since the chief product of the topping plant was fuel oil, and it was rarely necessary to produce finished distillates made in accordance with strict specifications, it was only necessary to obtain a satisfactory separation between the fuel residuum and the lighter products. The fuel residuum had to have a flash-point of 150° F. This was about the only specification that had to be met. The lighter fractions were all taken off together in one cut and sold as Tops to refiners who were in the business of making finished distillates for the market. To accomplish this crude separation between Tops and fuel oil, a distillation apparatus was next developed as follows: The cold crude was pumped through a pipe coil built into a brick furnace. This furnace was either heated directly by an oil or gas fire or, in the better built plants, the combustion took place in a Dutch Oven built in front of the furnace. The oil was heated in the pipe coil to a temperature sufficiently high to remove all the light products. The pipe still discharged into a vertical cylinder, entering the latter near the top. In this cylinder a separation took place between the vapors and the residual oil. The vapors passed out of the top of the cylinder and were condensed in the usual manner. The residual oil dropped to the bottom of the cylinder, where open steam was passed through it in order to remove any remaining light distillates which would unduly lower the flash-point of the fuel oil. The fuel passed from the bottom of the cylinder and ran into fuel tanks, first passing through a cooler, usually counter-current with incoming crude. This then was the original type of tubular topping plant which formed the basis of the distillation equipment now predominant in California.

Tubular Continuous Fractionation Apparatus

The first conspicuous attempt at combining maximum heat conservation with maximum operating flexibility in crude distillation was the development of the Trumble System of distillation. The most carefully designed and efficiently operated battery of cylinder stills with which the writer is acquainted has a thermal efficiency of 19.9 per cent. This figure is the ratio of the theoretical number of B. T. U.'s required for heating and evaporating, to the actual number of B. T. U.'s supplied. It takes into consideration the heat supplied by the superheated steam used in this plant through open coils. This steam is considered as a primary source of heat and no account is taken of either the thermal efficiency of the

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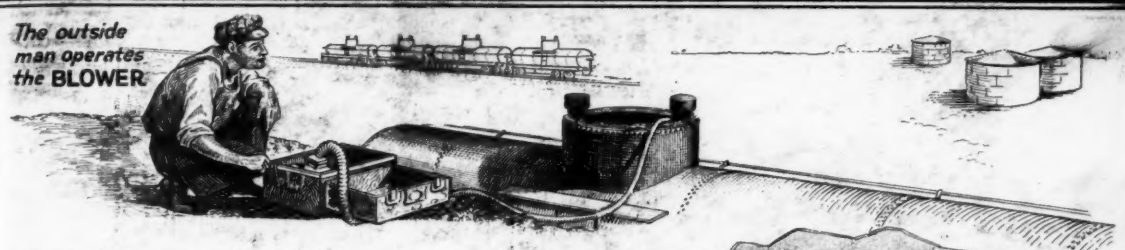

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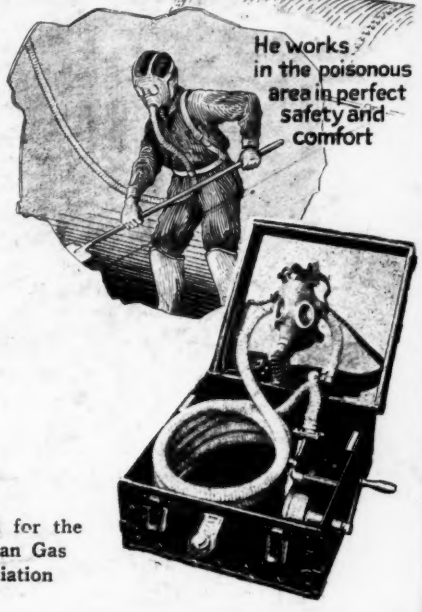

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boilers in which the steam is generated nor the superheaters through which it passes before reaching the stills. There is every reason to believe that this plant is as efficient as any cylinder still plant can be. The data from which the thermal efficiency was calculated were obtained over a full year of continuous operation. The plant consists of a battery of sixteen 300-barrel stills making a full line of products—from gasoline to cylinder stock. The fuel actually burned under the stills represents 4.7 per cent of the crude run or 7.1 per cent of the distillate taken off.

In a Trumble plant a thermal efficiency three times as high as that of the above cylinder still plant can be obtained without difficulty. This result is obtained not so much by more efficient combustion—for this would hardly be possible—but by more efficient utilization of the heat after it is transferred to the oil being handled.

The typical Trumble plant consists essentially of a pipe retort in which the oil is heated to a temperature high enough to remove the heaviest distillates desired, tking into consideration the amount of steam which is later injected into the system and which causes a partial pressure effect. The heated oil passes from the retort into an evaporator. The Trumble evaporator consists of a vertical steel shell surrounded by an annular flue. The combustion gases passing from the furnace of the pipe retort enter the annular flue surrounding the evaporator and pass up along the walls of the latter, finally leaving the system through a stack mounted on top of the evaporator. The interior of the evaporator is equipped with umbrella-like baffles coming within a fraction of an inch of the inner surface of the shell. The heated crude from the retort passes into the top of the evaporator and is deflected against the walls of the latter by the first umbrella. It is thus caused to run down the inner walls of the shell in the form of a thin layer. This layer of oil is further heated by the combustion gases passing up through the annular flue around the evaporator. Vapors passing from the film of oil in its course down along the sides of the evaporator are taken off through vents in the vapor line which passes down through the center of the shell and serves as a support for the umbrella baffles. When the residuum reaches the bottom of the evaporator it collects there to any depth desired. The bottom of the evaporator is provided with a perforated steam coil. This steam continues the removal of light vapors from the body of oil, and incidentally makes it possible to sufficiently reduce the flash-point of the residuum in order to make it meet the I. C. C. specifications for fuel oil. The residuum is continuously withdrawn from the bottom of the evaporator and the vapors are of course continually passing up through the vapor line in the center of the evaporator. In the ordinary cylinder still plant the hot residuum would be cooled by water, or in a limited number of cases would be put through a heat exchanger counter-current with incoming crude and be thus caused to impart some of its heat to the latter. In a cylinder still plant the vapors are always put through a condenser in which water is the cooling medium. These are not mere conventions, the practice being dictated by the necessity of having a cooling medium which can be varied with sufficient flexibility to take care of a wide variety of quickly changing operating conditions; for instance, when a cylinder still is operated on an intermittent basis, light gasoline will be coming off at the beginning of the run and then a few hours later lubricating distillate may be passing through the same condenser. Obviously, the lubricating distillate vapor, with the large amount of steam required to remove it from the oil, will require a great deal more provision for condensation than will the gasoline; therefore this varying condition can be met most conveniently by simply increasing the amount of cold water passing through the condenser.

In the Trumble system it is not necessary to provide for such quickly changing condensing conditions, as all the products which it is desired to remove from the crude are evaporated at once and then are successively condensed as their vapors leave the evaporator in a uniform stream. The separation of the composite vapors into the various commercial cuts desired is accomplished by a system of fractional condensation, provision also being made for re-distillation in much the same manner as the primary products of a cylinder still plant are re-distilled in steam stills. The important difference is that in a Trumble plant all the operations are carried out in one unit instead of several, and the best part of all is that in a large measure the condensation and cooling is accomplished

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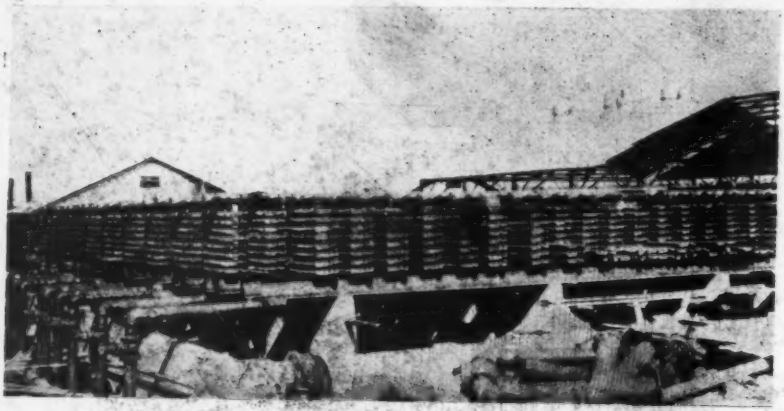

Seventy thousand square feet of Sterling oil condensing sections being placed in the Hanlon Gasoline Corporation's natural gasoline plant on the J. R. Smith lease, south of Breckenridge, Texas, is the largest installation ever made of this type of condenser coils, which are made by the American Radiator Company, and handled exclusively by the National Supply Company.

by various portions of the original crude as it passes through the plant. Likewise the partially finished cuts are largely re-distilled with heat supplied by residuum fresh from the evaporator instead of by steam especially generated for the purpose.

The following is a brief description of the course of the vapors from the evaporator through the remaining parts of a typical Trumble apparatus of the original type: First, the vapors pass through a series of dephlegmators. These dephlegmators are generally five or six in number. In each of them a certain amount of fractional condensation takes place and the condensate, or "bottoms" as it is generally known, may be either a finished commercial product or it may be a wide cut which requires refractionation. If a finished product, the "dephlegmator-bottoms" are cooled in tubular heat exchangers and passed through the tail-house into the run tanks. If the cut is too wide, it is run through a separator. This piece of apparatus functions in essentially the same manner as an ordinary steam still, except that it is designed for continuous operation instead of operating on the batch system. The "dephlegmator-bottoms" passing into the separator are heated by hot residuum passing through boiler tubes. Steam introduced through a perforated coil adds in the distillation. The vapors from the separator pass through small dephlegmators in order to improve the fractionation.

The rest of the Trumble apparatus consists of nothing more nor less than a variety of heat exchangers. These are arranged so that temperature differences between any oil or vapor are fully utilized; for instance, wherever it is possible to do so, vapors are condensed, not by water but by cold oil. Water for cooling and steam for heating are used only as auxiliaries in such cases where it is impossible to obtain the proper heat exchange between petroleum products already in the system. It is not within the scope of this article to give the technical details of the apparatus discussed. Anyone particularly interested in the Trumble system of distillation will find very detailed descriptions of apparatus and theoretical as well as structural calculations in U. S. Bureau of Mines Bulletin No. 162, and in a volume published during 1923 by E. H. Leslie entitled "Motor Fuels, Their Production and Technology" (The Chemical Catalogue Co., New York). It must be added, however, that neither of these two publications describe the latest type of Trumble apparatus now in use. Nevertheless, the fundamental principles have not changed, the only recent alterations being in the direction of increased thermal efficiency and closer fractionation. This brings us to the discussion of the most recent developments in the field of continuous fractional distillation in tubular apparatus.

Later Developments in Continuous Distillation

One of the most difficult problems in the field of heat exchange is the design of an efficient dephlegmator which is commercially practicable. To meet the latter specification such an apparatus must be simple in construction and its essential parts so placed that they are readily replaceable. Naturally the cost must be reasonable.

One of the weaknesses of the original Trumble system is that the fractionation was poor. In this system thermal efficiency was developed to a point which it is practically impossible to surpass. The fractionation, however, as has just been mentioned, left considerable room for improvement.

In the light of our present knowledge of dephlegmator design, we know that the cost of an apparatus capable of separating a vapor into two fractions having practically no overlap is prohibitive. Likewise, great loss is suffered if there is too much overlap and valuable hydrocarbons such as, for instance, those of the gasoline cut, are left in the heavier and commercially less valuable products; therefore a means must be found between excessively costly dephlegmation apparatus and excessively inefficient dephlegmation. The best practice at the present time seems to point toward the construction of dephlegmators having an efficiency of about 85 per cent. In the writer's viewpoint there is only one proper measure of dephlegmator efficiency: Ideal dephlegmation is attained when an apparatus takes a body of vapor and splits it into two fractions of which the end point of the lighter fraction is identical with the initial boiling point of the heavier fraction. From purely theoretical considerations it is evident that the construction of such an apparatus is impossible, nevertheless for purposes of comparison we are justified in assuming that if such dephlegmation could be obtained it would be 100 per cent efficient. Hence an apparatus with an efficiency of 85 per cent would be a dephlegmator producing two cuts of which the heavier would have an initial boiling point 15 per cent below the end point of the lighter cut; for instance, if the lighter cut had an initial boiling of 100° F. and an end point of 400°, it would have a boiling range of 300°. Eighty-five per cent of 300° would be 255°. This, plus the 100° initial, would permit an initial boiling point of 355° F. for the heavy cut if the dephlegmation is 85 per cent efficient. There are now in operation in California a number of tubular continuous distillation plants having the best thermal efficiency obtainable under the original Trumble system and in addition thereto having a dephlegmation efficiency in the neighborhood of 85 per cent. It is not, however, only in the direction of better fractionation that progress has been made in the development of oil distillation apparatus. The most modern units have a capacity three, four and five times as great as that of the Trumbles of eight years ago. One weakness of the Trumble evaporator is the difficulty in obtaining any real control of its temperature because of the annular flue around it. A personal equation always enters into the firing of any furnace. This together with the changes in firing required in raising and lowering the temperature of the oil passing through the retort, and then such uncontrollable factors as weather conditions, makes it practically impossible to maintain the evaporator at a constant temperature. In the more recently built plants of Trumble and other design the absence of the annular evaporator flue is noticeable. By doing away with this feature of the Trumble design no noticeable loss in thermal efficiency is suffered. An evaporator consisting of a vertical shell heavily lagged makes a piece of apparatus which is very easy to control.

Importance of Tubular Distillation Systems

The development of tube stills or pipe stills as they are frequently called, ranks in importance with the development of rotary drilling and the marketing of petroleum products through service stations. All three of these are developments of the highest importance in the petroleum industry. To most people the importance of service station marketing is obviously a great step in advance in the selling of oil. A smaller number realize the great changes which have been brought about in methods of oil production by the adoption of rotary drilling methods. Finally, very few people seem to realize the fact that continuous distillation in tube stills ranks with the other two developments in importance. It has made possible the handling of enormous quantities of oil through individual refineries without the greatly increased fire hazard involved in the operation of large numbers of cylinder stills in one plant. In a tubular continuous distillation system only a relatively small amount of oil is subjected to furnace heat at one time.

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RECENT REFINERY PATENTS ISSUED

BY STAFF REPRESENTATIVE

Washington, D. C.—The following patents of interest to the oil refining industry, have been issued during the month of March by the United States Patent Office:

No. 1,486,243: A process for treatment of oil shale and apparatus therefor; issued March 11, to George C. Hackstaff, Denver, Colo. This patent covers a process for treating oil shale and the like, comprising feeding the shale along an incline, bearing the same as it travels its inclined path, allowing it to fall after hearing, and spraying it with water as it falls, collecting the shale water and resulting oil, and allowing the oil to accumulate on the surface of the water.

No. 1,487,438: A method and apparatus for refining hydrocarbons, issued March 18, to Charles R. Burke, Tulsa, Okla., assignor to Louise P. Burke, Tulsa. In the art of treating hydrocarbon oils, the method covered by the patent consists in maintaining a body of hydrocarbon liquid in a holder, vaporizing and cracking hydrocarbon oil in a plurality of stills, conducting vapor from the stills through constricted passage ways and discharging it into said hydrocarbon oil and in the holder at a point below the surface of the oil therein, permitting the hot vapors to arise freely in the oil in said holder, thereby heating the last mentioned oil and at the same time condensing high boiling point fractions of the vapor, conducting vapor from the surface of the oil in the holder to a condenser, permitting the heated condensate to flow from the holder into the stills through said constructed passage ways, and leading a portion of the condensate from the holder to any of the stills without conveying the same through said passage ways.

The apparatus covered by the patent consists of a plurality of stills, a holder, a narrow passage way connecting each still to the holder and adapted to convey vapor from the still with which it is associated to the holder and to permit condensate from the holder to return to the still, a condenser operatively connected with said holder and conveying means for conducting a portion of the condensate from the holder to any of the stills without passing the same through said passage ways.

No. 1,487,541: Apparatus and method of extracting the petroleum content from petroleum-bearing sand or shale; issued March 18, to Jesse Coogan, Salt Lake City, Utah. The method covered by the patent comprises the agitation of the sand in water, the injection into said water during such agitation of a petroleum solvent, whereby the petroleum in said sand will be floated to the surface of the water, and the re-circulation of a portion of the petroleum so floated through the sand in the course of its continued agitation.

No. 1,488,325: A process for treating petroleum; issued March 25, to Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Company, Chicago. The patent covers a process of oil conversion which consists in passing hydrocarbon oil but once through a continuous elongated passage way, where the oil is subjected to a cracking temperature, in introducing the highly heated oil to an enlarged chamber with which said passage way communicates, in discharging the vapors from said chamber to a dephlegmator, in introducing charging stock to the dephlegmator to intimately commingle with said vapors to condense the heavier vapors and heat the stock, in discharging uncondensed vapors, in returning to the inlet side of said elongated passageway intermingled condensate and charging stock for passage therethrough, in withdrawing carbon containing residue from said enlarged chamber without permitting any portion thereof to again enter the elongated cracking passageway, and in maintaining a super-atmospheric pressure on said system.

McCorkle Will Build Plant at Port Aransas

Fort Worth, Texas.—The McCorkle Pipe Line Company has announced that a 20,000 barrel daily capacity skimming plant is to be erected at Aransas Pass, a deep water port on the Texas Coast, and orders for refinery equipment will probably be placed on or before May 1, with actual construction work scheduled to begin by July 1. This proposed refinery is to be used in connection with a pipe line system that is planned by the McCorkle Pipe Line Company from Southern Oklahoma through North and Central West Texas oil fields to the Coast, with extensions to oil fields in East Central and Southwest Texas. When completed the plant will be the closest in the United States to the Mexican oil fields.

Ira E. Eells, refinery superintendent for the Panhandle Refining Company at Wichita Falls, and formerly with the Evans-Thwing Interests of Kansas City, is to join the McCorkle Pipe Line Company April 15 to take charge of the construction and operation of the proposed 20,000 barrel plant.

According to Stephen R. McCorkle, chairman of the board of directors of the McCorkle Pipe Line Company, the company is being financed by the Prudential Trust Company, Montreal, and the Sterling Bond Company, Montreal and London, while the money is to be furnished largely by the same Canadian and British interests that financed the Dutch Shell group, and a crude contract has been made with Dutch Shell subsidiaries in Oklahoma and Kansas.

Anderson-Prichard Will Build New Skimming Plant

Colorado, Texas.—Materials are being assembled by the Anderson-Prichard Oil Corporation of Oklahoma City, Oklahoma, for the construction of a 2000 barrel daily capacity skimming plant on a 12 acre site located near the Colorado River at Colorado. A siding has been built to the refinery site by the Texas and Pacific Railroad. Crude will be obtained via pipe line from the Mitchell County oil field. The plant will manufacture gasoline, kerosene and fuel oil, and will cater to local trade while the surplus will be shipped out in tank cars to distant markets. J. Steve Anderson and L. H. Prichard are the principal stockholders of the concern erecting the plant.

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WHAT'S in a name, anyway? The refinery construction work we are doing under the name "Pioneer" is just the same high grade as when it bore the name "Tulsa Boiler and Sheet Iron."

For eighteen years, as the "Tulsa Boiler and Sheet Iron Works" we have turned out tanks and refinery steel construction that made good friends for us among the wise buyers of the Mid-Continent. We pioneered in giving these people "close to home" service on the best kind of work.

Now, under the new name, The Pioneer Tank and Boiler Company, we're all set with the men, machinery and money to keep on growing under the Pioneer banner like we did when Tulsa Boiler and Sheet Iron was on our letterhead.

There is no change in our organization.

Get Pioneer quotations on tank and refinery construction work.

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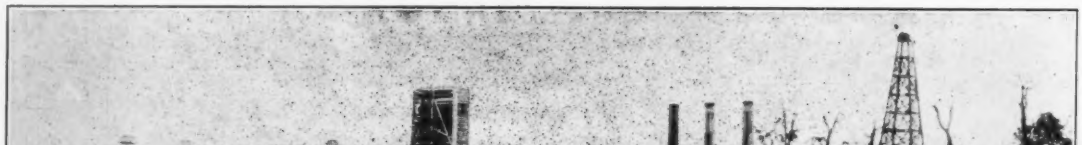

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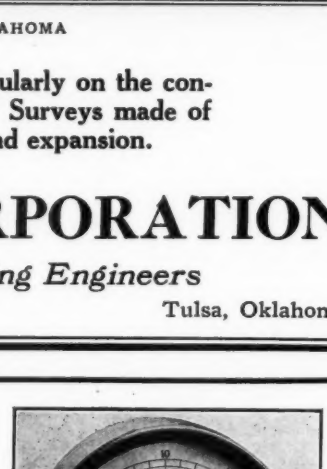

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Stabilized Gasoline Has Advantage in Blending

Recent improvements in manufacturing natural gasoline have resulted in stabilized gasoline, a product which is attracting widespread attention among gasoline manufacturers and refiners. The new process, which can be utilized in conjunction with any type of gasoline plant already in operation, eliminates from the product gas which is practically non-condensable and therefore undesirable.

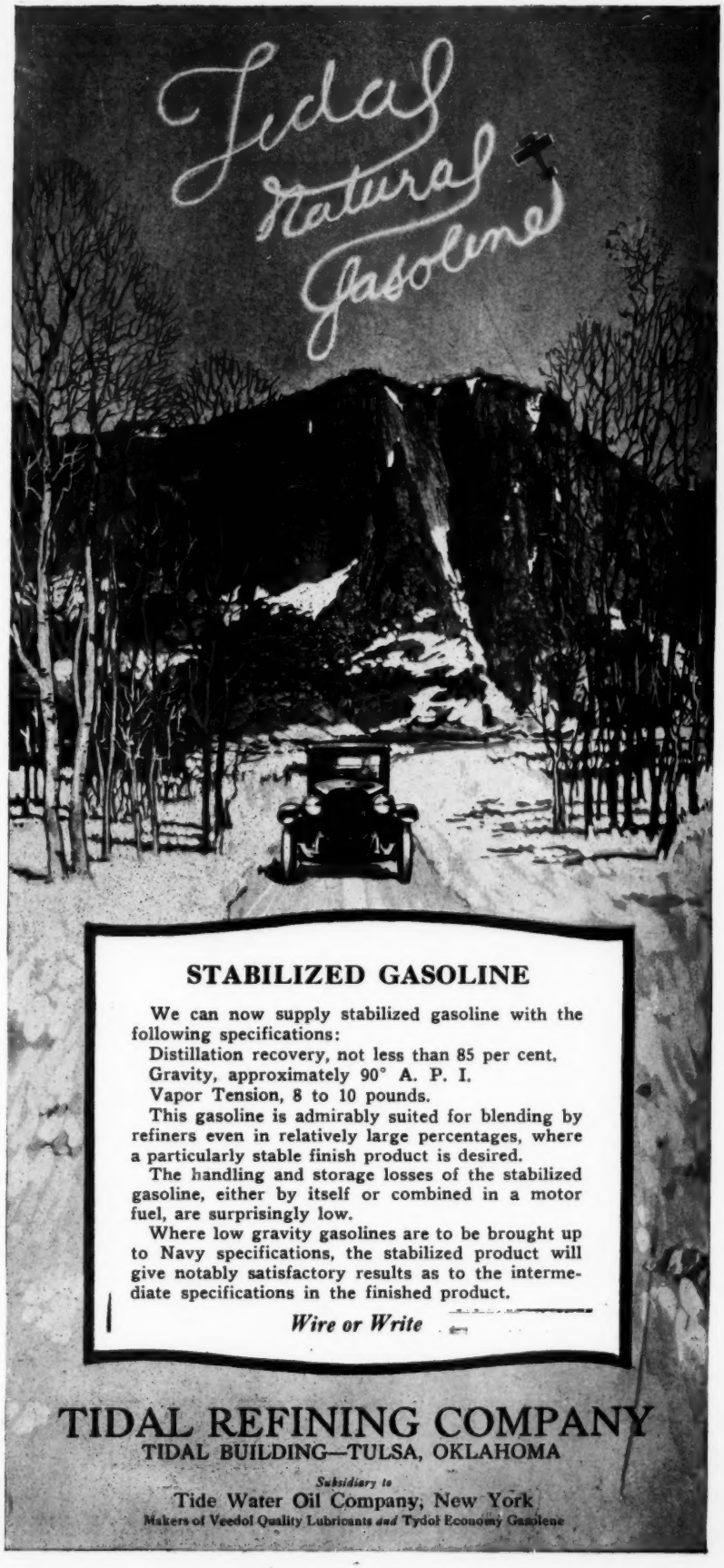
To the refiner the importance of stabilized gasoline lies in its absolute freedom from such gas, which is present in small quantities in natural gasoline as ordinarily marketed. In its effort to free itself from the liquid, this non-condensable gas, saturated with gasoline vapors, carries off the latter, agitating the liquid in the meantime and thus increasing the loss. Even though the natural gasoline is blended with refinery gasoline, there is still an evaporation loss due to the dissolved gas. But when natural gasoline is stabilized it can be loaded, unloaded, transferred or blended with losses which are almost negligible. The transfer losses will average only a fraction of one per cent in most cases. This can be more readily understood when a sample of the product is examined. It may be shaken or stirred without boiling or showing gas bubbles.

In distillation tests the superiority of the stabilized product is no less noticeable. When the latter is used, even in relatively large percentages, distillation recoveries of 97 to 98 per cent are easily obtained in the finished motor gasolines. For the efficient refiner, making navy gasoline or gasoline of similar specifications, this is very important. Refineries that are equipped and operated to obtain close fractionation find that the 90 per cent specification rather than the end point is the factor determining how deep cuts may be made. If the finished gasoline has a distillation recovery of only 95 per cent, there is only five per cent between the 90 per cent and the end point, whereas, with 97 per cent or 98 per cent recovery, there is seven or eight per cent between these two points. The higher recovery thus permits of the addition of heavy naphtha fractions with the finished gasoline still having 90 per cent off below 392° F.

F. W. Fraley, Jr., sales representative in the state of Louisiana for the Sinclair Refining Company of Louisiana, is confined to his home following a painful operation on his throat. Mr. Fraley will no doubt remain at home for several weeks.

J. W. Chadwick of Kansas City, Missouri, secretary and treasurer of the Western Gasoline Corporation, inspected the company's plant in Eastland County, Texas, late last month.

Willis Simms, formerly with the Universal Oil Products Company, owners of the Dubbs cracking process, Chicago, has been made refining superintendent for the Panhandle Refining Company's plant at Wichita Falls. Simms succeeds Ira E. Eells, who resigned effective April 15 to join the McCorkle Pipe Line Company.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Gasoline
STABILIZED GASOLINE
We can now supply stabilized gasoline with the following specifications:
Distillation recovery, not less than 85 per cent.
Gravity, approximately 90° A. P. I.
Vapor Tension, 8 to 10 pounds.
This gasoline is admirably suited for blending by refiners even in relatively large percentages, where a particularly stable finish product is desired.
The handling and storage losses of the stabilized gasoline, either by itself or combined in a motor fuel, are surprisingly low.
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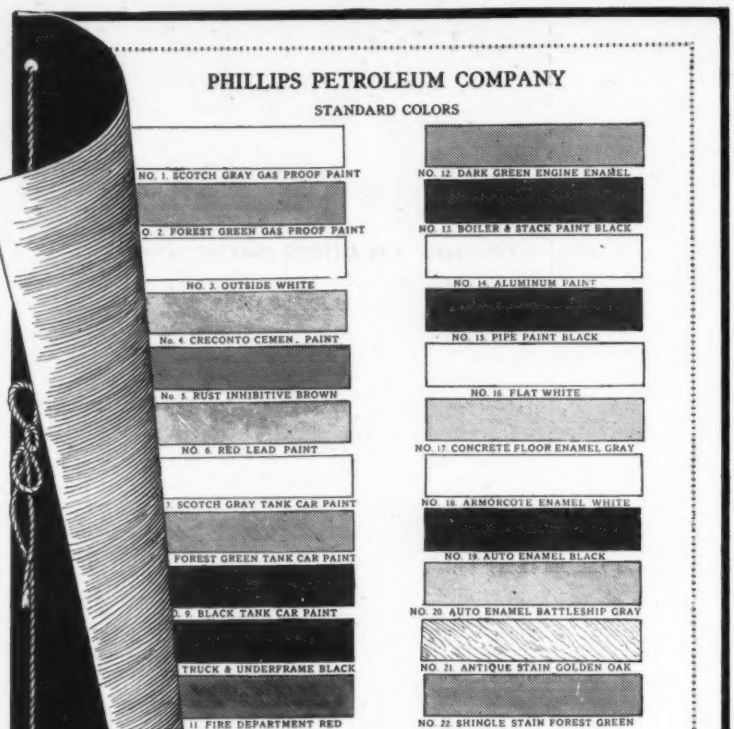
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Converting Smackover Crude Into Gasoline

Heavy Arkansas oil offers particularly fine charging stock for cracking

*By Gustav Egloff**

The daily production of Smackover crude oil is approximately 100,000 barrels of which 90,000 is so-called heavy oil. The present market value of Smackover crude of 24 Baume gravity or less is 55 to 65 cents per barrel.

The heavy Smackover crude oil contains practically no gasoline, and is used largely for fuel oil purposes. However, the real value lies in its conversion into commercial yields of gasoline. This oil makes particularly fine charging stock for cracking, due to its ease of conversion into gasoline under commercial conditions of operation.

In a typical commercial run with the Dubbs process on Smackover crude oil of 20.0 Baume gravity 36.5 per cent was converted into Navy specification gasoline; 18.7 per cent gas oil and 42.6 per cent fuel oil. This was accomplished with one passage of the crude oil through the apparatus.

When one considers that the Smackover heavy oil field is producing at the rate of 35,000,000 barrels a year, it is important to know that this barrelage can be converted into 530,000,000 gallons of gasoline for the year. The present economic value of the crude oil could be greatly enhanced by conversion into gasoline and the cost of cracking but slightly above that of a skimming plant. Assuming the entire Smackover heavy crude oil to be cracked into gasoline, it would mean that this one oil field of Arkansas would produce over eight per cent of the total gasoline produced in the United States during the year 1923.

Smackover Crude Oil Used as Charging Stock
(Analysis)
Baume Gravity, 20.0
Initial Boiling Point 240°F.

Per Cent by Vol.	Temp. degs. F.	Baume Gravity
5	410	46.0
10	480	37.0
20	565	32.5
30	610	29.0
40	632	28.8
50	590	32.0
60	540	35.6
70	570	33.0
80	610	33.0

The operating conditions maintained during the run in a plant having a rated capacity of 250 barrels per day were as follows:

Hours to bring still on stream.....3½
Hours still was on stream.....52
Pressure lbs. per sq. inch.....135
Liquid Temperature .....870°F. (Approx.)
Dephlegmator tempertaure ....500°F. (approx.)
Barrels per hour on stream—
Smackover Crude Oil.....17.1
Pressure Distillate Oil Produced..... 9.9
Residuum 7.3

*Director, Research Laboratories, Universal Oil Products Co., Chicago, Ill.

The mode of operation of the apparatus is to first purge the system of all air which may be present, by charging the system with oil and testing it by applied pressure for possible leaks. The plant being found tight, the fires are started and circulation of oil through the system starts by convection. As the oil is heated, certain fractions are vaporized, displacing the oil in the dephlegmator; the oil thus displaced being withdrawn from the system through an open residuum line and returned to the raw oil charging tank. This procedure is followed until a working level of oil is established in the system, at which time, the raw oil charging pumps are started and the pressure allowed to build up in the system. The oil discharging from the heating coil shortly thereafter reaches the operating temperature and as the vapors and noncondensable gas produced generate the required pressure, craking begins and pressure distillate is produced. At this time, the operating temperature and pressure are maintained constant by the release of noncondensable gas, and regulation of the amount of oil passing through the heating coil by means of speed regulation of the raw oil charging pump.

The raw oil is pumped partially into the dephlegmator and heating tubes. The portion of raw oil pumped to the dephlegamator cools to a liquid, the heavier portion of the vapors ascending from the expansion chamber. The blended raw charging oil and condensed vapors flow by gravity into the heating coil, where they are subjected to the temperature conditions of cracking. Cooling of the dephlegmator may be effected by pumping back into it pressure distillate, in which case the raw oil is charged directly into the heating coil.

The furnace temperature is maintained constant by burning fuel oil and the uncondensable gas produced by the process. The transfer temperature of the oil leaving the heating coil passing to the expansion chamber is maintained uniformly by pumping in raw oil at a constant rate. The residuum oil is drawn from the expansion chamber continuously at a uniform hourly rate. At the top of the dephlegmator the cracked light vapor temperature is controlled by means of the raw oil being pumped therein, and this in turn yields a definite quality of pressure oil at a uniform rate; which is withdrawn from the receiver continuously into a gas separating chamber. The pressure is controlled upon the entire system by means of a needle valve upon the receiver, leaving the uncondensable gas escape at a regulated rate for use as fuel in the process.

Mechanical Arrangement

The apparatus for carrying out the cracking process consists of:

(a.) Furnace comprised of two compartments, one of which is used for the combustion chamber, while the other contains the heating tubes and around which the products of combustion pass.

(b.) A continuous series of four inch diameter seamless steel heating tubes connected with steel return bends.

(c.) The steel return bends are provided with openings, so as to allow of flue cleaners passing into the steel tubes. The openings are closed with special allow bronze plugs which are excellent seals preventing leaks of any kind.

(d.) From the last steel tube, there is a pipe connection, to transfer the liquid to the top of a reaction chamber.

(e.) The reaction chamber is a hammer welded one, of ten foot diameter and fifteen foot high and tested to stand a pressure five times its required strength at the operating temperature. The chamber is provided with residual oil draw off connections and liquid level determination device. Steam connections are provided, so as to thoroughly steam out the chamber at the end of a run. A vapor line is connected to the top of the chamber. The reaction chamber is insulated and no external heat comes in contact with the chamber. The chamber is located several feet away from the furnace.

(f.) The vapor line leading from the top of the reaction chamber is connected to the bottom of the dephlegmator.

(g.) The dephlegmator consists of the pan type; its purpose is to fractionate the heavier vapors from the cracked product issuing from the reaction chamber. The dephlegmator is provided with a reflux oil pipe connection to the combined feed in the oil line going to the heating coil of the furnace. Approximately one-half way down the center of the dephlegmator the raw oil discharges, in part condensing the heavier vapors while the lighter cracked vapors pass out of the top of the dephlegmator to the water condenser.

(h.) The lighter cracked vapor cooling coil condenser is contained in a water box provided with inlet and outlet for the water which is pumped in continuously.

(i.) A pressure distillate receiver is provided to collect the condensed pressure distillate oil and uncondensable

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gas. The pressure distillate oil is continuously drawn out by means of a control to a gas separating tank.

(j.) The gas separating tank which is maintained under a much lower pressure than the rest of the system, allows the dissolved gas in the pressure distillate oil to release itself and pass out, combining with the noncondensable gas from the pressure distillate receiving tank.

(k.) The uncondensable gas and separated dissolved gas from the pressure distillate oil are connected with pipe and burner arrangement so that they may be burned as fuel in the furnace.

(l.) A residuum oil cooling coil is provided to bring the temperature to atmospheric temperature. The piping and control valve for the continuous residuum flow-out of the reaction chamber, is connected to the cooling coil.

(m.) A raw oil charging pump is provided to pump the oil to the dephlegmator or directly to the heating coil or split the stream of oil to both these parts of the system.

(n.) Meters are provided for recording the amount of raw oil flowing into the system and for the pressure distillate oil recirculated and produced.

(o.) Pressure gauges for recording the pressure in the apparatus are installed.

(p.) Emergency draw off line is provided leading to a sump.

(q.) Recording and indicating pyrometers are provided to show the temperatures at various points in the system.

Products Resulting from Cracking

The primary products resulting from cracking reaction are:

1. Pressure Distillate Oil: The pressure distillate oil is refined by means of sulphuric acid of 66 Be. degrees, caustic sodium plumbite. The chemically refined pressure distillate is steam distilled or steam and fire distilled into water-white gasoline and gas oil. The gas oil is useful for cracking stock and may be blended with raw charging oil. The further uses for the gas oil may be illuminating gas production, light fuel oil or Diesel engine.

2. Residuum: The residuum oil makes an excellent fuel oil or may be distilled to coke and the oil recovered utilized for cracking stock. The oil may also be steam distilled so as to produce asphaltic like material.

3. Coke: The coke has a high heat content per pound and can be used for fuel, electrodes, briquets or perhaps metallurgical purposes.

4. Uncondensable Gas: The uncondensable gas may be converted in part by proper chemical means into alcohols or other derivatives of chlor characteristics. It can readily yield lampblack by burning in an insufficient atmosphere of oxygen. Due to its high heat content per cubic foot it has uses for welding purposes. The gas makes an excellent fuel and blended with water-gas could be utilized for domestic heat or lighting.

SMACKOVER CRUDE OIL
Summary of Run
(Made in plant having rated capacity of 250 barrels per day.)

Hours fire on stream	3½
Hours on stream	52

Type B-540 Gasoline Condenser
(Patented)

Compact — Efficient — Flexible

Dimensions — overall, 30″ x 30″ x 9′-0″ (inc. top and bottom bonnets)

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Hills-McCanna No. 45 is a copper, aluminum, iron alloy which has proven very satisfactory wherever corrosion is encountered. Its use has solved many a troublesome situation, especially in oil refineries, chemical, explosive, tanning and dye industries.

We invite you to make a test of this material to solve any problem where corrosion exists.

Hills-McCanna No. 45 will "hold up" under severe tests. Due to its tensile strength and acid resistance, it is far more satisfactory than any of the non-ferrous alloys with strength sufficient to hold under high pressure and temperatures.

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We again invite you to state your problems to us.

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$4,350 —a year's fuel saving with Graver-softened water

The poor transfer of heat through scale-coated tubes brought a severe fuel loss to the Skelly Oil Company of El Dorado, Kansas.

A GRAVER Hot Process Softener was installed, and the hardness of the water immediately reduced from 10 grains to 1 to 1½ grains per gallon.

The complete elimination of scale troubles is bringing about a saving, in fuel alone, of $4,350 during the first year's operation—a return of 87% of the entire cost of the softening equipment.

In addition, they now have clean, dry steam for the steam stills. And condenser boxes and pipes are no longer coated with scale.

"Our apparatus," says Mr. O. C. Smith, Asst. Superintendent of the company, "is doing its work satisfactorily and saving nearly $5,000 per year in items that we can evaluate. It also effects other savings as yet intangible, which could easily double that amount." Longer use will show a considerable reduction in tube renewals and repairs.

Read the complete story of the Skelly installation in the Nielsen Report No. 16. It offers one more proof of the fact that GRAVER Softeners are highly profitable investments for power plants not having soft water.

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Pressure	135

	Bbls.	Grav.
Charging Stock—Smackover Crude	890	20.0

RESULTS FROM CRACKING

	Bbls.	Be. Gr.	% of Raw Oil
Pressure distillate	517	49.6	58.1
Residuum	379	5.5	42.6

YIELD FROM PRESSURE DISTILLATE

	Bbls.	Be.Gr.	IBP-EP	% of Pres. Dist.	% of Raw Oil
Gasoline	325	55.1	108-431	62.8	36.5
Gas Oil	166			32.2	18.7
Loss	26			5.0	2.9

PERCENTAGES OF YIELD BASED ON RAW OIL CHARGED

	% of Raw Oil
Gasoline	36.5
Gas Oil	18.7
Fuel Oil	42.6
Unc. Gas; Carbon and Loss	2.2

Lone Star to Take Gas From Landreth Plant

Breckenridge, Texas.—A market for the residue gas from the Landreth Gasoline Company's big natural gasoline plant in the Ibex field, Shackelford County, will be provided within three months as result of a contract made with the Lone Star Gas Company early in March. This latter concern is serving 70 cities and towns in North and Central Texas with gas for domestic and industrial use, and within the past six months has contracted with a number of gasoline plants in Eastland County for residue gas, thereby affording the plant owners a new source of revenue as they were without a market for the residue.

A gas main consisting of 21 miles of 16 inch pipe and 11 miles of 12½ inch pipe will be required to connect the Landreth Gasoline Company's plant to the Lone Star Gas Company's trunk line at Ranger, and a 12 unit compressor station is to be erected at the plant. The Landreth Interests are to bear the costs of building this gas line, and have organized the Landreth Gas Company with a capitalization of $1,000,000 to finance the project, but will be reimbursed by the Lone Star Gas Company within a specified period of time. The contract made by the Landreth Interests with the Lone Star Gas Company calls for a minimum of 20,000,000 cubic feet of gas daily, although twice this amount is available at the Ibex plant.

Upon the completion of this gas line it is understood that an extension is to be made to the Curry and Breckenridge fields in Stephens County to purchase residue gas from other plants. The Lone Star Gas Company's trunk line system leading from Central West Texas oil fields to Fort Worth and Dallas is one of the largest of its kind in the country, being 65 miles of 18 inch and 35 miles of 16 inch line, besides many miles of 12½ inch and smaller gathering lines.

Many Plants to Be Built In Rocky Mountain Field

Casper, Wyo. — The abundance of wet gas in the Wyoming oil producing areas offers a big field for the growth of the natural gasoline manufacturing industry, and the number of plants in the state are being increased each year. The gasoline yield from this gas averages about the same as that obtained in the Mid-Continent district. The Department of Interior is encouraging the operators on Government land to erect more plants in the fields, and extract the gasoline before the gas is utilized for fuel or wasted for lack of a market.

Construction work is to be started shortly on a new plant in the Salt Creek field by the Staley Syndicate, and when completed the plant will have a daily charging capacity of 2,000,000 cubic feet of gas. Mineral seal absorption process is to be installed in this plant, and a yield of about 5,000 gallons of gasoline daily is expected.

The E. T. Williams Oil Company has announced that its natural gasoline plant in the Salt Creek field is to be changed from compression to the absorption process, and the capacity will be increased to 2,000,000 cubic feet daily. Gas run through this plant offers a yield of about one and a half gallons of gasoline per 1000 cubic feet.

The Producers and Refiners Corporation is making preparations to rebuild the absorbing units of its natural gasoline plant located on the gas main connecting Casper with the Lost Soldier field. This plant is equipped to handle in excess of 35,000,000 cubic feet of gas daily.

E. A. Huffin, former manager of the Tulsa office of the Grandfield Oil & Refining Company, is now manager in charge of sales and purchases, of the Mid-Continent Petroleum Products Company.

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Swift Shipments from

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We make and market all grades of natural gasoline. You can get what you want, right on the dot, when you entrust your order to Akin.

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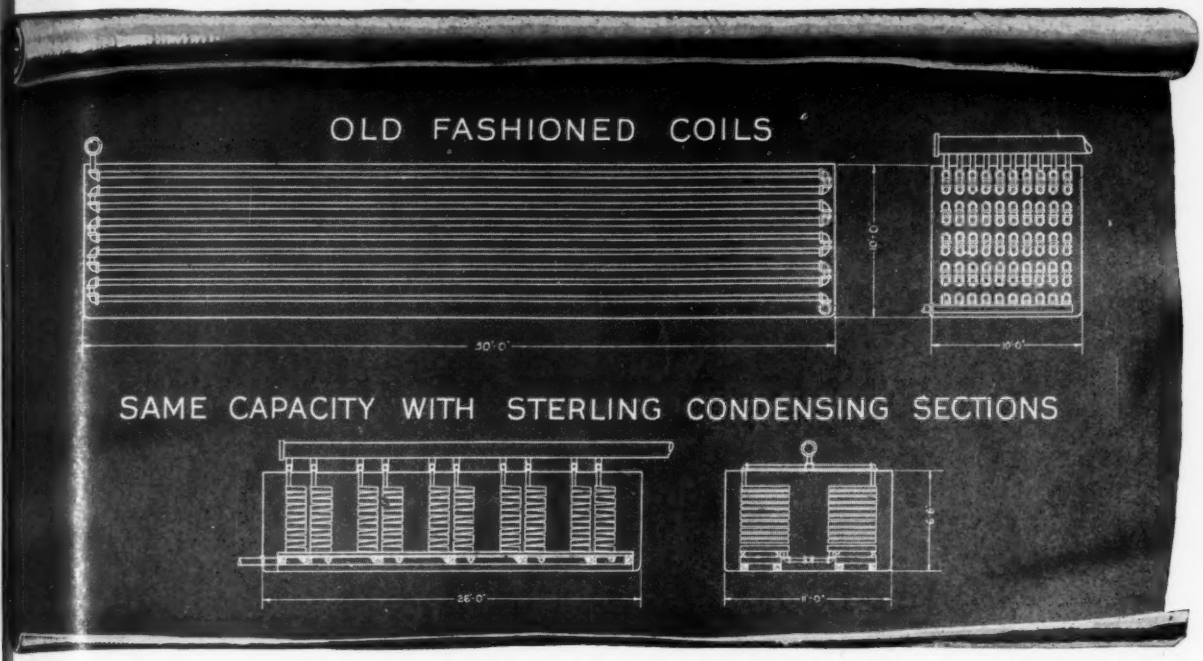


Which costs more to build?

A condenser box 50 ft. long x 10 ft. wide x 10 ft. high

—OR—

A condenser box 26 ft. long x 11 ft. wide x 6½ ft. high?

THE ANSWER is easy. Yet both boxes will hold the same amount of condensing surface.

Why the difference in size?

The first box is designed for coils, the second for Sterling Condensing Sections, but only 37% as much box area is necessary for the Sterling Sections as for coils.

Not only do Sterling Sections require much smaller boxes than coils, for the same amount of condensing surface; not only can practically twice the same amount of condensing surface be put into the box originally built for coils, but—

Sterling Sections require less support in the box than coils,

—are more easily arranged for permanent low end temperatures,
—condense more rapidly,
—reduce receiving house temperatures (as much as 10°),
—have longer life (the cast iron resists rust and action of sulphur and other corrosives),
—are much easier to remove for cleaning, repair or replacement,
—can be taken down easily and quickly for reassembly.

One of our engineers will be glad to call and tell you how Sterling Sections can be used economically and effectively in your plant.

STERLING OIL CONDENSING SECTIONS

AMERICAN RADIATOR COMPANY

Industrial Sales Offices: 1807 Elmwood Ave., Buffalo, N.Y.

STERLING CONDENSING SECTIONS ARE IMMEDIATELY AVAILABLE AT OUR PLANTS IN
Kansas City, Mo. Springfield, Ohio Buffalo, N.Y.

R. B. Meter Indicates Individual Boiler Load

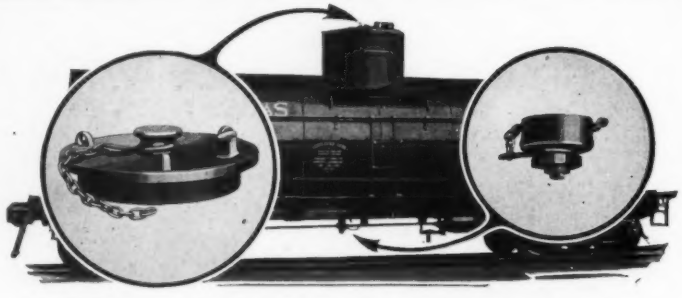
In order to meet the requirements of plants operating a few boilers of 100 h.p. capacity or less, the Republic Flow Meters Company has brought out its R. B. Meter which indicates the load carried on each boiler.

The R. B. meter system is electrically operated and consists of three parts: the meter body, the boiler front indicator, and the medium used to obtain a differential pressure, either of the pitot tube or orifice plate type.

The meter body is built of semi-steel. It is practically a reproduction at a slightly smaller scale of the Standard R. S. meter body, and reads accurately to within one and one-half per cent. The boiler front indicator is 12 inches in diameter and is marked with one-inch figures easily read at long range.

With the R. B. meter, it is very easy to detect lagging or overloaded equipment. If a sudden steam demand impends, the fireman is warned in sufficient time to provide for it, and when the demand drops off, he is likewise warned to curtail steam production.

Further information can be secured by writing the Republic Flow Meters Company, 2240 Diversey Parkway, Chicago, Illinois.



WE CAN SAVE YOU MONEY

Use our dome covers and outlet caps, products that are backed by our years of experience in manufacturing high quality products for the oil industry. They are always dependable and our service is prompt. Wire or write. Quotations furnished on Brake Shoes, Gray Iron Castings, Plate Work, Beams, Sheet and Structural Steel.

Oil Well Rig Irons and Refinery Equipment

Western Iron & Foundry Co.

Wichita, Kansas

READING

CAST STEEL GATE VALVES

Reading Cast Steel Gate Valves are built for high temperature work, particularly. The flexible construction and suspension of the disc and the method of setting in and backing up the seat ring provide for keeping the valve tight when expansion begins. The steel you are familiar with in Reading Fittings.

READING STEEL CASTING CO., INC.

An Associate Company of the American Chain Co., Inc.

BRIDGEPORT, CONNECTICUT

Stocked by

NORVELL-WILDER Hardware Co., Beaumont, Houston, Mildred and Shreveport.

GRINNELL CO., OF THE PACIFIC, Los Angeles, California

Tnemec Has Aluminum Paint For Gasoline Storage Tank

Kansas City, Mo. — Tnemec Paint and Oil Company announces a new aluminum paint which is ready for distribution.

This aluminum paint has aluminum bronze as its pigment, coupled with pure linseed oil. The pigment gives a bright metallic finish.

The company recommends this paint for all gasoline storage tanks, tank cars, agitators, coils and wherever else gasoline is subject to evaporation.

Further information may be secured by writing the Tnemec Paint and Oil Company, Kansas City, Missouri, or any branch of the Continental Supply Company.

Calorizing Company Has New Booklet for Trade

Upon request to the Calorizing Company, Pittsburgh, Pennsylvania, executives in industries where heat-enduring castings are in demand, may secure copies of "Heat Enduring Castings," a book recently published by the Calorizing Company.

The book is based on many years of experience in the production of heat-enduring alloys by the General Electric Research Laboratory, by Victor Hybinette and other engineers.

Chapter headings are as follows: introductory, heat endurance, higher quality at lower prices, temperature range, uses, general data.

Super Tip for Torches Is New Milburn Product

Announcement is made by the Alexander Milburn Company of a new "Super Tip" for its metal cutting torches. It is claimed that this tip embodies all the desirable features of the standard tip and has many additional features which make it an improvement.

The distinctive features of this tip are a method of super-mixing the gases and preheating the cutting oxygen as well as giving added velocity and penetration to the preheating and cutting jets. The tip can be provided with a new seat at a fraction of the cost of a complete tip. This renewable seat facilitates the cleaning and maintenance of the tip.

The mixture of the preheating gases takes place in multiple passages in the renewable seat. These gases then pass into an annular passage where they are given a swirling motion and an additional mixing. Then the gases are again separated and expanded into enlarged multiple passages leading to the orifices in the tip proper.

Further information can be obtained by writing the Alexander Milburn Company, 1416-1428 W. Baltimore St., Baltimore, Maryland.

H. H. Rathvon, formerly refinery superintendent of the Sunburst Refining Company of Great Falls, Montana, has accepted a similar position with the Omaha Refining Corporation, Omaha, Nebraska. The latter company is owned by the E. T. Williams Oil Company, Casper Wyoming, and is operating on Salt Creek crude, running 1500 barrels a day. Recently a Cross cracking plant was finished at the Omaha plant and has completed its second run.

natural gasoline

grade "a"

GRAVITY.....Not below 72° Be.
Not above 78° Be.
E. P.....Not over 375° F.
RECOVERY.....Not less than 90%

grade "b"

GRAVITY.....Not below 76° Be.
Not above 82° Be.
E. P.....Not over 375° F.
RECOVERY.....Not less than 85%

grade "c"

GRAVITY.....Not below 80° Be.
Not above 88° Be.
E. P.....Not above 350° F.
RECOVERY.....Not less than 78%

grade "d"

GRAVITY.....Not below 88° Be.
Not above 92° Be.
E. P.....Not above 350° F.

In order to meet the rapidly growing demands, we have materially increased our production of Natural Gasoline.

Your orders will receive prompt and careful attention from us.

Before buying Natural Gasoline always get a quotation from

C&S CORPORATION

grade "1"

GRAVITY.....Not below 58° Be.
Not above 62° Be.
E. P.....Not over 437° F.
RECOVERY.....Not less than 91%

grade "2"

GRAVITY.....Not below 58° Be.
Not above 62° Be.
E. P.....Not over 450° F.
RECOVERY.....Not less than 90%

grade "3"

GRAVITY.....Not below 64° Be.
Not above 66° Be.
E. P.....Not over 440° F.
RECOVERY.....Not less than 88%

grade "4"

GRAVITY.....Not under 66° Be.
Not over 70° Be.
E. P.....Not over 435° F.
RECOVERY.....Not less than 85%

CHESTNUT & SMITH CORPORATION

GENERAL OFFICES - CHESTNUT SMITH BLDG. - TULSA OKLA.

LUCEY

"Wherever LUCEY There's Oil"

STEEL CASTINGS FOR REFINERIES

Open Hearth Process

Quick Delivery—Made in Houston

From One Pound to 8000 Pounds

Analysis of Every Heat Controlled in Our Own Laboratories, Insuring Uniform Quality.

Complete Pattern Shop, Machine Shops, Metallurgical and Engineering Staff at Your Disposal.

R. U. CULBERSON, Receiver

LUCEY MANUFACTURING CORPORATION OF TEXAS

Houston, Texas

Beaumont, Texas Shreveport, La. El Dorado, Ark. Mexia, Texas
Smackover, Ark. Corsicana, Texas Dallas, Texas

STEEL

Fulton House Service Regulator

With the aid of the FULTON HOUSE SERVICE REGULATOR, any intake pressure up to 100 pounds may be reduced to a delivery pressure of a few ounces. The renewable valve seat can be replaced in a few moments; and without the necessity of taking the entire regulator apart. The springs are of special construction and will not break or lose their elasticity. Write for further details.

Chaplin-Fulton Mfg. Co.

28-36 Penn Ave., Pittsburgh, Pa.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of the Refiner and Natural Gasoline Manufacturer, published monthly at Houston, Texas for April 1st, 1924.

State of Texas,
County of Harris—ss.

Before me, a Notary Public in and for the State and County aforesaid, personally appeared A. L. Burns, who, having been duly sworn according to law, deposes and says that he is the Treasurer of The Refiner and Natural Gasoline Manufacturer and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, The Gulf Publishing Company, 1716 Dallas Ave., Houston, Texas.

Editor, R. L. Dudley, 1716 Dallas Ave., Houston, Texas.

Associate Editor, Spencer W. Robinson, 1716 Dallas Ave., Houston, Texas.

Business Manager, R. L. Dudley, Houston, Texas.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of the stockholders owning or holding 1 per cent or more of the total amount of stock.)

Jas. Anderson, Houston, Texas; R. L. Blaffer, Houston, Texas; Mrs. S. C. Blaffer, Houston, Texas; A. L. Burns, Houston, Texas; R. E. Connell, Pittsburgh, Pa.; H. W. Draper, Houston, Texas; Dr. N. L. Dudley, Goose Creek, Texas; R. L. Dudley, Houston, Texas; B. V. Ellzey, El Paso, Texas; W. S. Farish, Houston, Texas; D. H. Freel, Casper, Wyo.; Dr. J. L. Gross, Kansas City, Mo.; Howard R. Hughes Estate, Houston, Texas; Chas. H. Lane, Houston, Texas; W. B. Larkin, Wichita Falls, Texas; J. H. McEvoy, Houston, Texas; J. H. McEvoy, Jr., Houston, Texas; W. A. Miles, Ft. Worth, Texas; C. F. Mirus, Tampico, Tamps., Mexico; Mrs. J. B. Moore, Houston, Texas; David M. Picton, Jr., Houston, Texas; Wallace E. Pratt, Houston, Texas; Spencer W. Robinson, Houston, Texas; J. E. W. Schneider, Houston, Texas; C. N. Scott, Houston, Texas; R. S. Sterling, Houston, Texas; Jno. R. Suman, Houston, Texas; Wm. A. Vinson, Houston, Texas; E. C. Waldvogel, Pelham, New York; Bud Waller, Chicago, Ill.; C. F. Williams, Humble, Texas; E. E. Watt, Houston, Texas; G. C. Wood, Houston, Texas; R. L. Young, Houston, Texas.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

H. C. Weiss, Houston, Texas; Jas. Anderson, Houston, Texas; Howard R. Hughes Estate, Houston, Texas; R. L. Blaffer, Houston, Texas; W. S. Farish, Houston, Texas; Chas. H. Lane, Houston, Texas; John Hammond, Houston, Texas; R. S. Sterling, Houston, Texas; Maurice Hirsch, Houston, Texas.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stocks and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

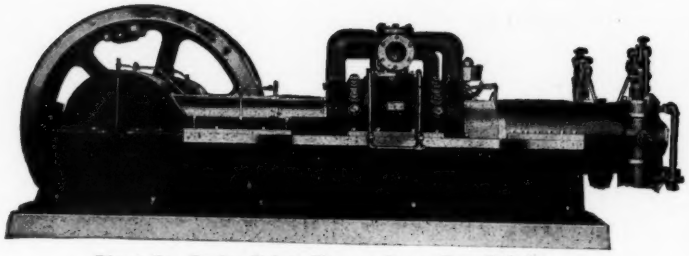
5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is ..... (This information is required from daily publications only.)

A. L. BURNS, Treasurer.

Sworn to and subscribed before me this 2nd day of April, 1924.

(Seal) Maurice Hirsch,
(My commission expires June 30th, 1924.)

THE NEW ENCLOSED TYPE



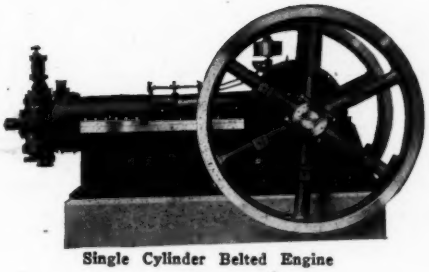
Direct Gas Engine Driven Vacuum Pump, Two Cylinder

Watts-Miller Gas Engines and Direct Gas Engine Driven Compressors and Vacuum Pumps

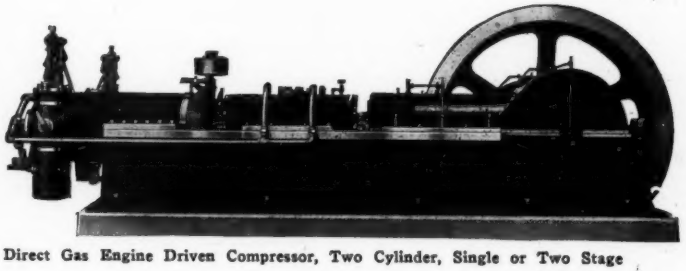
Pat. June 22, 1897; Oct. 6, 1914; April 13, 1915

High Efficiency Gas Engines, Compressors, and Vacuum Pumps for Power Plant Equipment

Sizes from 50 to 400 h. p.



Single Cylinder Belted Engine



Direct Gas Engine Driven Compressor, Two Cylinder, Single or Two Stage

Compressors particularly adapted to casing-head gasoline plants, gas pumping plants, and compressed air installations, in single and 2-stage machines to operate on practically all intake and discharge pressures. Continuous circulating filtering automatic oiling system.

The Miller Improved Gas Engine Co.

SPRINGFIELD, OHIO

WESTERN DISTRIBUTORS

C. E. Ingalls,
Rialto Building,
San Francisco, Calif.

Miller Improved Gas Engine Co.,
Branch Sales Office, also Warehouse and Service,
323 North Cheyenne Ave., Tulsa, Oklahoma

Frick-Reid Supply Co.,
Casper, Wyoming

÷ REFINERY SUPPLIES ÷

Refiners' Supplies

	April 1
Soda Ash light 58% ....cwt.	$1.38–1.50
Silicate of Soda 60 deg. bbls....cwt.	1.75
Sal Soda wks ....cwt.	1.10–1.25
Caustic Soda 76% ....cwt.	3.10
Chloride of Lime solid....cwt.	1.90–2.30
Sulphuric Acid 60 deg. tank cars f. o.b. shipping point....per ton	10.00–12.00

Benzol—

Pure Water White....Tanks....gal.	.25	—.30
Drums....gal.	.30	—.35
90% ....Tanks....gal.	.23	—.28
Drums....gal.	.28	—.33

Jobbers' Supplies

Vegetable Oils—

*Linseed, carloads Spot ....gal.	—.90
March ....gal.	—.90
Less carload Spot ....gal.	—.95
5 bbls. or less Spot....gal.	—.98
Boiled, tank Spot ....gal.	—.88
Boiled, carloads Spot....gal.	—.94
Soya Bean Spot, Tanks....lb.	—.10¼

Animal Oils—

English Degras ....lb.	$–.04¾
Domestic Degras, bbls., carloads....lb.	–.03¼
Horse ....lb.	.08

Oleic Acids—

Dist ....lb.	.08¾–.09¼
Saponified ....lb.	.08¾–.09¼

Lard Oils—

Prime	
Winter	
Strained ..1 to 1½ ffa. 40/45c t. lb.	.14
Extra	
Winter	
Strained....2 to 4½ ffa. 40/45c. t. lb.	12¼
Extra....4 to 5 ffa. 40/45c. t. lb.	11¾
Extra No. 1....7 to 10 ffa. 40/50c. t. lb.	.11¼
Extra No. 1...15 to 18 ffa. 40/50c. t. lb.	.11
No. 2....22 to 23 ffa. 40/45c t. lb.	.10½
Prime Edible Tallow under 1⅞ ffa. 40/45c t. N. Y....lb.	.08¾–.08¾
Tallow acidless ....lb.	—.11¼
Lard Stearine ....lb.	—14
Oleo Stearine ....lb.	—.09¼

Neatsfoot Oil—

Pure ....bbls.-lb.	—.14¾
Extra ....bbls.-lb.	—.11¼
No. 1 ....bbls.-lb.	—.10¾
Cold pressed ....lb.	—.17½

Fish Oils—

Menhaden Oil	
Light pressed ....gal.	–.60
White ....gal.	.65–67
Yellow bleached ....gal.	.63–.65
*Herring, tankcars coast....gal.	–.50
Whale, extra winter bleached ....gal.	–.81
Seal	Nominal

Naval Stores—

Turpentine, N. Y. ....gal.	$1.03
†Turpentine ....gal.	.97¼
Rosin B. N. Y. ....bbl.	5.70
Rosin F. N. Y....bbl.	5.70
Rosin B.† ....bbl.	4.75
Rosin F.† ....bbl.	4.75
Rosin Oil 1st run....gal.	.43
Rosin Oil 2nd run....	.47

Pine Tar—

Kiln Burnt ....Bbl.	11.00
Retort ....Bbl.	11.00

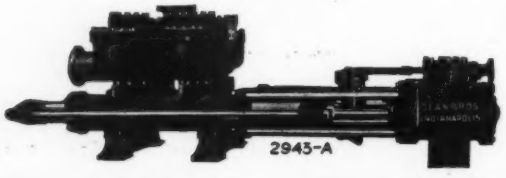
*Nominal
†Savannah, Ga., market.

DEAN BROS. CO.
INDIANAPOLIS.

OIL PUMPS
For Hard Continuous Service

The pumps will not short stroke. Are substantially and carefully built. Have large and free passages which do not restrict the flow. Extremely economical in the use of steam.

Send for Catalogue.



Established 1857

The Vilter Manufacturing Co.

1152-1162 CLINTON ST., MILWAUKEE, WIS.

Vilter High Speed Horizontal Refrigerating Machine

Builders of Refrigerating Machinery, Oil Cooling Coils, Gasoline Condensers, Etc.

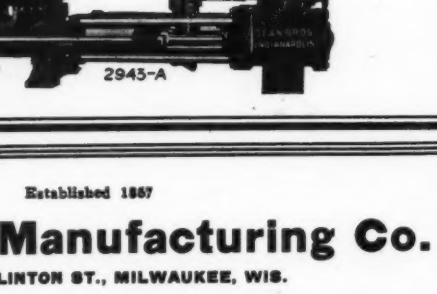
Vilter Equipment is used in many of the oil refineries.

Vilter-Milwaukee typifies the true standard of reliability in machinery construction and refrigerating engineering.

Vilter Low Temperature Compression System (for efficiently producing low temperatures with compression system.)

Vilter Sales Engineers always at your service.

Branch offices in all the principal cities.



Federal Case Against Old Dominion Company Started

Houston, Texas, April 11.—The trial of the federal government against Oscar L. Pardue, J. F. Lewis, John DeBrueys, and J. J. Edwards, charged with using the mails to defraud, is in progress here. The men mentioned are originators of the Old Dominion Oil Company, a promotion scheme.

Literature issued by the company was read at the trial. The pamphlets were proved to be false in their statements by witnesses testifying today.

So far, practically every claim made by the company has been shown to be contrary to fact and more witnesses for the government are to be introduced.

A Dependable Guide to Dependable Power

The New WESTERN Bulletin #400

A Single "Western" Engine Frequently Has Changed the Complete Power Policy of an Entire Company

WESTERN MACHINERY COMPANY

on

Duplex and Twin Duplex Gas Engines is finished and will be mailed you on request

Bulletin No. 400 gives complete data on the Duplex and Twin Duplex Types of "Western" Gas Engines including detailed specifications, sectional drawings, photographs and installations.

If you use power, Bulletin No. 400 will be a valuable help in selecting efficient, dependable power units.

Bulletins on Other WESTERN Products—

Bulletin No. 112:
"Western" Type "G" Engines
25 to 80 H. P. Single Cylinder

Bulletin No. 212:
"Western" Type "G" Hoists
25 to 60 H. P. Single Cylinder.

Bulletin No. 312:
"Western" Oil Field Engines
25 to 40 H. P. Single Cylinder.

Bulletin No. 322:
"Western" Type "R" Reverse Gear.

Bulletin No. 512:
"Western" Diesel Stationary
25 H. P. Cylinders in Multiples up to six.

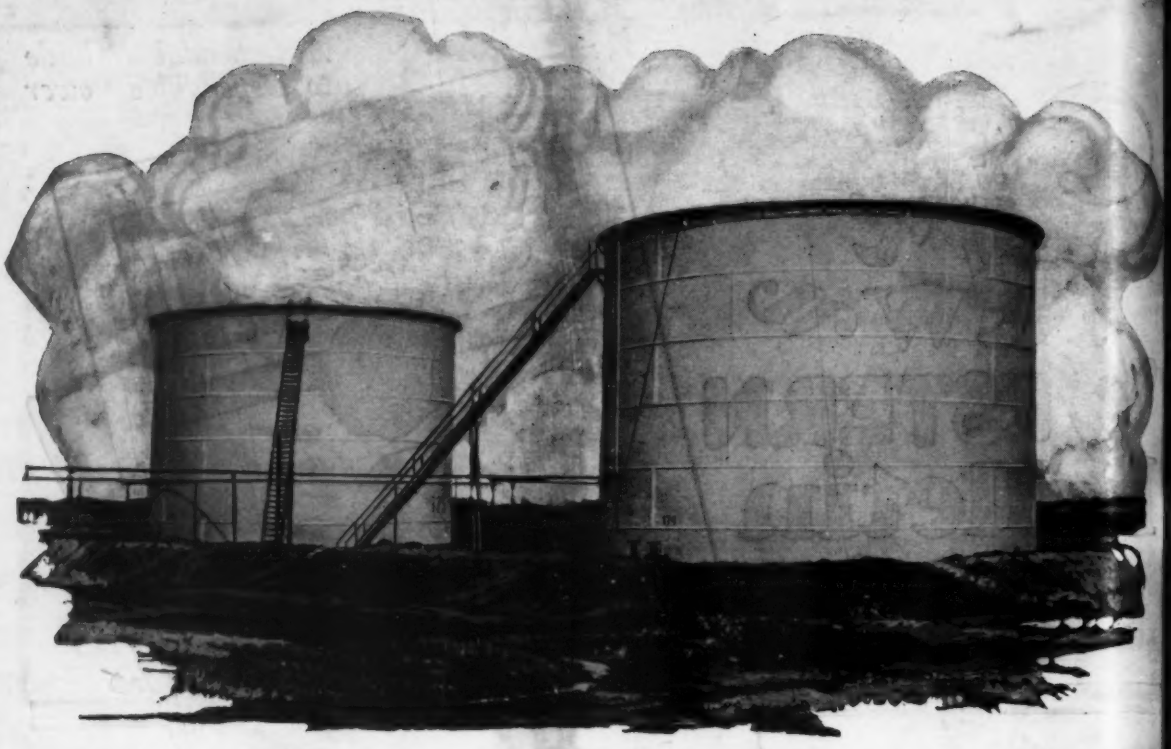
"Western" Diesel Marine Engines
75 to 100 H. P. 3 and 4 Cylinder units.

Western Machinery Company

905 N. Main St., Los Angeles, Calif.

Tulsa	Okmulgee	San Francisco	Bakersfield
Oklahoma	Oklahoma	California	California

WESTERN



Aluminum Tank Paint Cuts The Loss

The use of Degraco Aluminum Tank Paint provides the highest degree of light reflection and the lowest degree of heat absorption that can be obtained by any practical method for cutting down evaporation losses.

Actual field tests have shown that tanks on which this paint is used remain so cool that there is no need to resort to water spraying or other artificial methods of cooling. The result is a saving that amounts to far more than the relatively low cost of painting and maintenance.

Degraco Aluminum Paint is not easily stained by oil leakage — nor is it darkened by hydrogen sulphide fumes as are so many paints when exposed to oil field conditions. The reason for this is that the Degraco Aluminum Paint Formula *provides the right blend of vehicles and pigment* to meet the known conditions of exposure and service.

Send for complete information on Degraco Aluminum Tank Paint including data on tests of its effectiveness in reducing evaporation losses.

Degraco Products

Tank Paints
Head Liner Enamels
Tank Car Paints
Pipe Line and Station Finishes
Superior Graphite Paint
Sta-White
Degraco Paints for Houses
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DEGRACO PAINTS

All Colors for Your Particular Needs

(223)

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Detroit Graphite Company

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Manufactured in Canada by Dominion Paint Works, Limited, Walkerville, Canada

DEGRACO PAINTS are sold through branch offices with warehouse stocks in all principal cities.

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